DRAFT ENVIRONMENTAL ASSESSMENT

COUGAR DAM DOWNSTREAM PASSAGE
WILLAMETTE RIVER BASIN
SOUTH FORK MCKENZIE RIVER, OREGON

U.S. Army Corps of Engineers, Portland District
333 SW 1ST AVE, PORTLAND, OR 97208

Environmental Assessment
Cougar Dam Downstream Fish Passage Project
Willamette River Basin
South Fork McKenzie River, Oregon
January 2019

Responsible Party: The responsible lead Federal agency for this Environmental Assessment (EA) is the U.S. Army Corps of Engineers, Portland District (Corps). The National Marine Fisheries (NMFS), U.S. Fish and Wildlife Service (USFWS), and the Oregon Department of Fish and Wildlife are cooperating agencies.

Abstract: The Corps proposes to construct a downstream passage facility and make improvements to and continue the operations and maintenance of associated fish facilities to enhance fish passage through the Cougar Dam and implement the NMFS Reasonable and Prudent Alternative (RPA) Measure 4, Fish Passage, as recommended in the *Endangered Species Act Section 7(a)(2) Consultation, Biological Opinion and Magnuson-Stevens Fishery Conservation & Management Act Essential Fish Habitat Consultation on the Willamette River Basin Flood Control Project* (BiOp) issued July 11, 2008 (NMFS 2008). USFWS similarly issued a BiOp in 2008 for the effects of the Willamette Valley System on Oregon chub (*Oregonichthys crameri* - now delisted), bull trout (*Salvelinus confluentus*), and bull trout critical habitat. The USFWS BiOp reached a no jeopardy determination as long as the Corps implements the NMFS RPA and considers the effects of NMFS' RPA on Oregon chub and bull trout.

This EA evaluates the potential environmental effects of implementing downstream passage at Cougar Dam to meet the NMFS fish passage guidelines and Corps operator safety requirements. The dam and reservoir are located within areas deemed critical habitat for Upper Willamette River (UWR) Chinook salmon with high conservation value. The South Fork McKenzie population of UWR Chinook salmon is considered to be at moderate risk of extinction based on an analysis of its recent abundance, productivity, spatial structure, and diversity.

The Corps considered various alternatives for downstream passage. The alternatives were then further refined to two alternatives: the No Action Alternative and the proposed action consisting of a Floating Surface Screen (FSS) fish collector paired with truck and haul to transport the fish downstream of Cougar Dam. Although the facility would be designed based on criteria for Chinook salmon, the facility design also accommodates other fish species, including cutthroat trout, resident rainbow trout, and bull trout. The Corps evaluated alternatives based on biological efficiency, constructability, environmental impact, operation, and overall cost. The agency proposed action provides for a volitional swim-up facility, the

ability to hold fish, and the capability for water-to-water transfer of fish from the FSS to the point of release in the river downstream of the dam. The agency's proposed action works within the Cougar Dam authorized purposes, allows for the continued operations of the dam for temperature control, is a gravity-fed system, and meets the project objectives.

The proposed action would meet the Corps' purpose and need to enhance downstream passage and meet the requirements of the RPA of the NMFS and USFWS 2008 BiOps. Long-term effects of the project would be beneficial to fish as the action will result in improvements to the survival of fish spawned upstream of the Cougar Dam. However, short-term negligible to moderate effects would result from construction-related activities.

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AFCF	adult fish collection facility
aMW	average megawatts
APE	area of potential effect
AQI	Air Quality Index
ATU	Accumulated Thermal Units
AV	Amphibious Vehicles
BiOp	Biological Opinion
BMPs	Best Management Practices
BPA	Bonneville Power Administration
CAA	Clean Air Act
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CFD	Computational Fluid Dynamics
cfs	cubic feet per second
COP	Configuration/Operation Plan
CRR	Cohort Replacement Rate
CWA	Clean Water Act
ODEQ	Oregon Department of Environmental Quality
EA	Environmental Assessment
EDR	engineering documentation report
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESCP	Erosion and Sediment Control Plan
ESU	Evolutionary Significant Unit
EWEB	Eugene Water and Electric Board
f/s	feet per second
FBW	Fish Benefits Workbook
FERC	Federal Energy Regulation Commission
FSC	Floating Surface Collector
FSO	Floating Surface Outlet
FSS	Floating Screen Structure
ft	feet
HEC-ResSim	Hydrologic Engineering Center Reservoir Systems
HGMP	Hatchery Genetic Management Plan
HRA	Heritage Resource Associates
kW	kilowatts
LRAPA	Lane Regional Air Protection Agency
MAII	may adversely impact individuals
MAR	Mountain Anthropological Research

NAAQS	National Ambient Air Quality Standards
N*e*	effective population size
NEPA	National Environmental Policy Act
NF	National Forest Road
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination Systems
OARRA	Oregon Archaeological Records Remote Access
OCCRI	Oregon Climate Change Research Institute
ODFW	Oregon Department of Fish and Wildlife
ODWR	Oregon Water Resource Department
O&M	operations and maintenance
ORV	outstandingly remarkable values
PM	particulate matter
RM&E	Research, Monitoring, and Evaluation
RPA	Reasonable and Prudent Alternative
RO	Regulating Outlet
SHPO	State Historic Preservation Office
SLAM	Species Lifecycle Analysis Module
SOC	Species of Concern
SRKW	Southern Resident Killer Whales
SSC	suspended sediment concentration
SWS	Selective Withdrawal Structure
TDG	total dissolved gas
TMDL	Total Maximum Daily Load
VSP	Viable Salmonid Population
USBR	United States Bureau of Reclamation
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
UWR	Upper Willamette River
WATER	Willamette Action Team for Ecosystem Restoration
WFFDWG	Willamette Fish Facility Design Working Group
WCM	Water Control Manual
WNF	Willamette National Forest
WTCT	water temperature control tower
WVS	Willamette Valley System

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1. INTRODUCTION

The U.S. Army Corps of Engineers (Corps) prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EA has been prepared in accordance with the NEPA of 1969 (as amended), the Council on Environmental Quality's NEPA regulations (40 C.F.R. parts 1500-1508), and the USACE's NEPA regulations (33 C.F.R. part 230). This EA discloses the direct, indirect, and cumulative environmental impacts that will result from the alternatives, including for Alternative 2, of the proposed action.

1.10 DOCUMENT STRUCTURE

The Corps has organized this document into eight parts:

1. Introduction: This section includes information on the project history, the purpose and need for the project, the lead agency and cooperating agencies of the project, and the direct or indirect consequences of project implementation.
2. Alternatives: This section provides a detailed description of the alternatives for meeting the project purpose and need, including those alternatives the Corps eliminated from further consideration and the criteria utilized to screen alternatives. Finally, this section describes the features of Alternative 2 (the proposed action). The No Action Alternative is included in the array of alternatives considered.
3. Affected Environment and Environmental Effects: This section describes the existing environmental conditions that the project implementation may affect. This section also describes the probable environmental direct and indirect effects of implementing the alternatives not eliminated for further consideration and analyzes the potential cumulative impacts that may occur following implementation of these alternatives when considered with other past, present, and reasonably foreseeable actions. Within each section, the effects of the No Action Alternative provide a baseline for evaluation and comparison to the action alternatives.
4. Cumulative Impacts: This section analyzes the potential cumulative impacts that may occur following implementation of the proposed action when considered with other past, present, and reasonably foreseeable actions.
5. Review and Consultation: This section provides a list of tribes and agencies consulted during the EA development and summarizes the Corps' public involvement activities for the project.
6. Compliance with Laws and Regulations: This section discusses the project's compliance with laws including the Endangered Species Act (ESA), the Clean Water Act (CWA), the National Historic Preservation Act (NHPA), as well as executive orders such as environmental justice.

7. List of Preparers: This section provides a list of individuals that contributed to the development of the EA.
8. References: This section provides a list of references cited within the EA.

1.11 BACKGROUND

The Corps proposes to construct and operate a downstream fish passage facility to enhance fish passage through the Cougar Dam. This projects implements the National Marine Fisheries Service (NMFS) Reasonable and Prudent Alternative[1] (RPA) Measure 4, Fish Passage, as required to avoid jeopardy in their *Endangered Species Act Section 7(a)(2) Consultation, Biological Opinion and Magnuson-Stevens Fishery Conservation & Management Act Essential Fish Habitat Consultation on the Willamette River Basin Flood Control Project* (BiOp) issued July 11, 2008 (NMFS 2008).

The Corps operates 13 dams and reservoirs in Oregon's Willamette River Basin, which collectively comprise the Willamette Valley System (WVS). Principally, three separate Flood Control Acts authorized the WVS: 1938, 1950, and 1960. House Document 531, as incorporated by the Flood Control Act of May 17, 1950 (81st Congress, 2nd Session), remains the overall guiding document pertaining to the operation and maintenance of the WVS. The United States Congress authorized the WVS with full recognition that it would cut off extensive areas of upstream habitat. To compensate, Congress authorized fish hatcheries and other measures such as fish collection facilities to mitigate the loss of access to upstream habitat.

Listing several species under the ESA required an assessment of the effects of operations of the WVS by the Corps' Portland District. From that assessment, NMFS issued the July 2008 BiOp evaluating the effects of the continued operation and maintenance of the WVS to species under their jurisdictional purview and listed under the ESA. NMFS concluded that the Corps' proposed operation of the WVS was not sufficient to avoid jeopardy or adverse modification of designated critical habitat for two fish species: Upper Willamette River (UWR) Chinook salmon (*Oncorhynchus tshawytscha*) and UWR steelhead (*O. mykiss*). The Cougar Dam and Reservoir are located within areas deemed critical habitat for UWR Chinook salmon and have high conservation value (NMFS 2008). Large dams restrict access to historical spawning and rearing areas in the four historically most productive tributaries, including the McKenzie River basin by Cougar Dam. Although an adult fish facility provides access to historically high quality habitat in

[1] Reasonable and prudent alternatives in a BiOp are alternative methods of project implementation, offered in a biological opinion reaching a jeopardy or adverse modification conclusion that would avoid the likelihood of jeopardy to the species or adverse modification of critical habitat. In the case of the 2008 BiOp, the project implementation refers to the continued operations of the WVS.

the South Fork McKenzie River and its tributaries above Cougar Dam for migrating adults, poor downstream fish passage continues to limit access for the McKenzie River population. The NMFS BiOp included an RPA to the Corps' proposed continued operation and maintenance of the WVS that, if implemented, would avoid the likelihood of jeopardy to listed species or adverse modifications to their critical habitats. The RPA includes measures for fish passage, water quality, flows, water contracts, habitat improvements, and hatcheries. Specifically, RPA 4.12.1, "Cougar Dam Downstream Passage", states that the Action agencies (the Corps and the Bonneville Power Administration (BPA)) "will investigate the feasibility of improving downstream fish passage at Cougar Dam through structural modifications as well as with operational alternatives; if found feasible, the Action agencies will construct and operate the downstream fish passage facility."

Cougar Dam and Reservoir are located in areas deemed "critical habitat essential for the conservation of bull trout" (USFWS, 2010). Similar to the NMFS, the U.S. Fish & Wildlife Service (USFWS) issued a BiOp in 2008 outlining the effects of the WVS on Oregon chub (*Oregonichthys crameri* - now delisted), bull trout (*Salvelinus confluentus*), and bull trout critical habitat. The USFWS BiOp reached a no jeopardy determination as long as the Action agencies implement the NMFS RPA and consider the effects on Oregon chub and bull trout when applying measures proscribed in the RPA.

This EA evaluates the potential environmental effects of constructing, operating, and maintaining downstream fish passage at Cougar Dam while meeting the NMFS fish passage design guidelines (NMFS 2011) as well as meeting the Corps' requirements for operator safety. This EA provides the necessary analysis for determining whether to prepare an environmental impact statement or finding of no significant impact.

1.12 Purpose and Need

1.12.1 Purpose

The purpose of the Cougar Dam Downstream Passage Project (the Project) is to, consistent with authorized project purposes, enhance downstream passage for listed populations of UWR spring Chinook salmon on the South Fork McKenzie River to reaches downstream of Cougar Dam. To complete the Project necessitates making improvements to, and continuing the operations and maintenance of, associated fish facilities.

1.12.2 Need

The underlying need for this project is to meet the NMFS and USFWS BiOps RPA requirements for continued operations of the WVS (NMFS 2008) identified to avoid jeopardy of

ESA listed fish. Specifically, the RPA outlines the need for this project under Measures 4.12.1 and 4.1 of the RPA. Measure 4.12.1 provides that the Action agencies “investigate the feasibility of improving downstream fish passage at Cougar Dam through structural modifications as well as with operational alternatives, and if found feasible, they will construct and operate the downstream fish passage facility.” Measure 4.1 provides that the continued capture of UWR spring Chinook salmon below several Corps dams, including Cougar Dam, and transporting them into habitat upstream of these dams.

1.12.3 Purpose and Need Background

The 2008 BiOp identifies the lack of passage as the most substantial limiting factor to the viability of the affected populations of UWR Chinook salmon. Although Cougar Dam’s construction included both upstream and downstream passage facilities, low adult returns due to inadequate migration temperatures caused by the dam and inefficient collection and high mortality of juveniles led to the eventual closure of both facilities. Since 1993, the Corps has transported hatchery-origin adults above the dam in an effort to enhance upstream habitat through the delivery of marine-derived nutrients for bull trout recovery. The Corps began transporting natural origin UWR Chinook salmon above the dam in 2010, when the existing Adult Fish Collection Facility (AFCF) was completed. Genetic pedigree analysis found that neither the 2007 or 2008 adult cohort replaced itself through adult recruitment to the AFCF, likely as a result of poor downstream passage conditions; even so, the risk of extinction for UWR Chinook salmon released above Cougar was low (Banks et al. 2014).

By providing adults with access to upstream spawning habitat and juveniles with access downstream to the ocean for growth to maturity, a downstream fish passage project at Cougar Dam will increase the numbers of UWR Chinook salmon. With respect to critical habitat, this project will address the Habitat Access pathway described in the 2008 BiOp by improving access past physical barriers, thereby improving the status of primary constituent elements for spawning, rearing, and migration of UWR Chinook salmon. NMFS deems this project to be an essential step toward addressing the need for juveniles to migrate downstream and complete their life cycles. The Corps may need to make improvements to the Cougar AFCF to facilitate downstream passage as it provides a good location to release the downstream migrating fish collected in the reservoir as a part of the project. The Cougar Trap and Haul Facility EA (USACE 2006) describes the Cougar AFCF. The Corps completed the AFCF in 2010. Operations and maintenance may change in response to the implementation and operation of the Project.

1.13 LEAD AGENCY

The Corps is the lead federal agency for compliance with NEPA for this proposed action. As lead agency, the Corps ensures overall compliance with environmental laws and regulations regarding the proposed federal action.

1.14 COOPERATING AGENCIES

In accordance with 40 C.F.R. § 1501 .6 of the Council on Environmental Quality's NEPA implementing regulations, and based on their jurisdiction by law and/or special expertise, NMFS, USFWS, and Oregon Department of Fish and Wildlife (ODFW) have agreed to participate as cooperating agencies in the project for the purposes of satisfying NEPA requirements for the proposed NEPA process.

1.15 AREA OF AFFECT

For the purpose of this analysis, the Corps has defined the area of affect as all areas that the project may be directly or indirectly affected by the proposed action. This includes Cougar Dam and Reservoir as well as some access roads and staging sites, and the South Fork McKenzie River from the base of Cougar Dam to the confluence with the McKenzie River (approximately 4.2 miles) (Figure 1). The proposed action may affect water quality in the McKenzie River from its confluence with the South Fork McKenzie River to the Willamette River; therefore, this stretch of river is included in the area of affect (Figure 1).

About 70% of the sub-basin is federal forestland, with the Willamette National Forest (WNF) accounting for nearly the entire area above the Blue River confluence, except for private in-holdings near the main McKenzie (Figure 2). Forested tributaries to the McKenzie below Blue River, and particularly below Vida (at RM 41), have mixed to strongly private ownership as the river flows to and through Willamette Valley bottomlands that begin near Deerhorn Bridge at RM 32. Residential and agricultural use has converted much of the valley floor below this bridge (MWC 1996). The majority of the sub-basin is located in Lane County, Oregon, with a small portion in Linn County. The largest city in the sub-basin is Springfield, with a population of 59,403 (2010). Immediately to the west is Eugene, with a 2010 population of 156,185, according to the U.S. Census. Lumber is the primary Basin industry; however, the extensive fish and wildlife resources and natural areas contribute to a major recreational economic base.

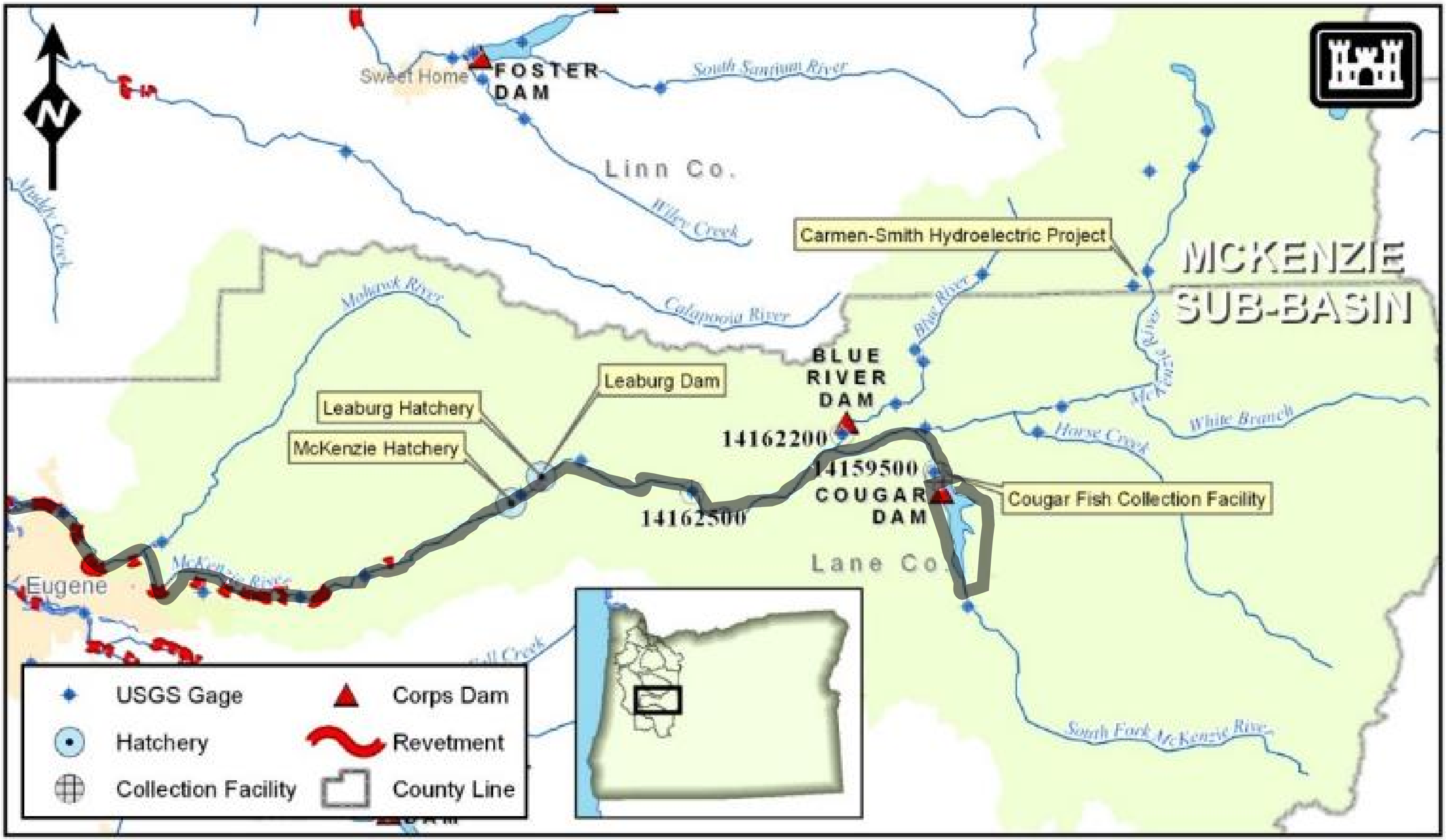

Figure 1. McKenzie River Sub-basin – the Area of Affect is signified by gray shading.

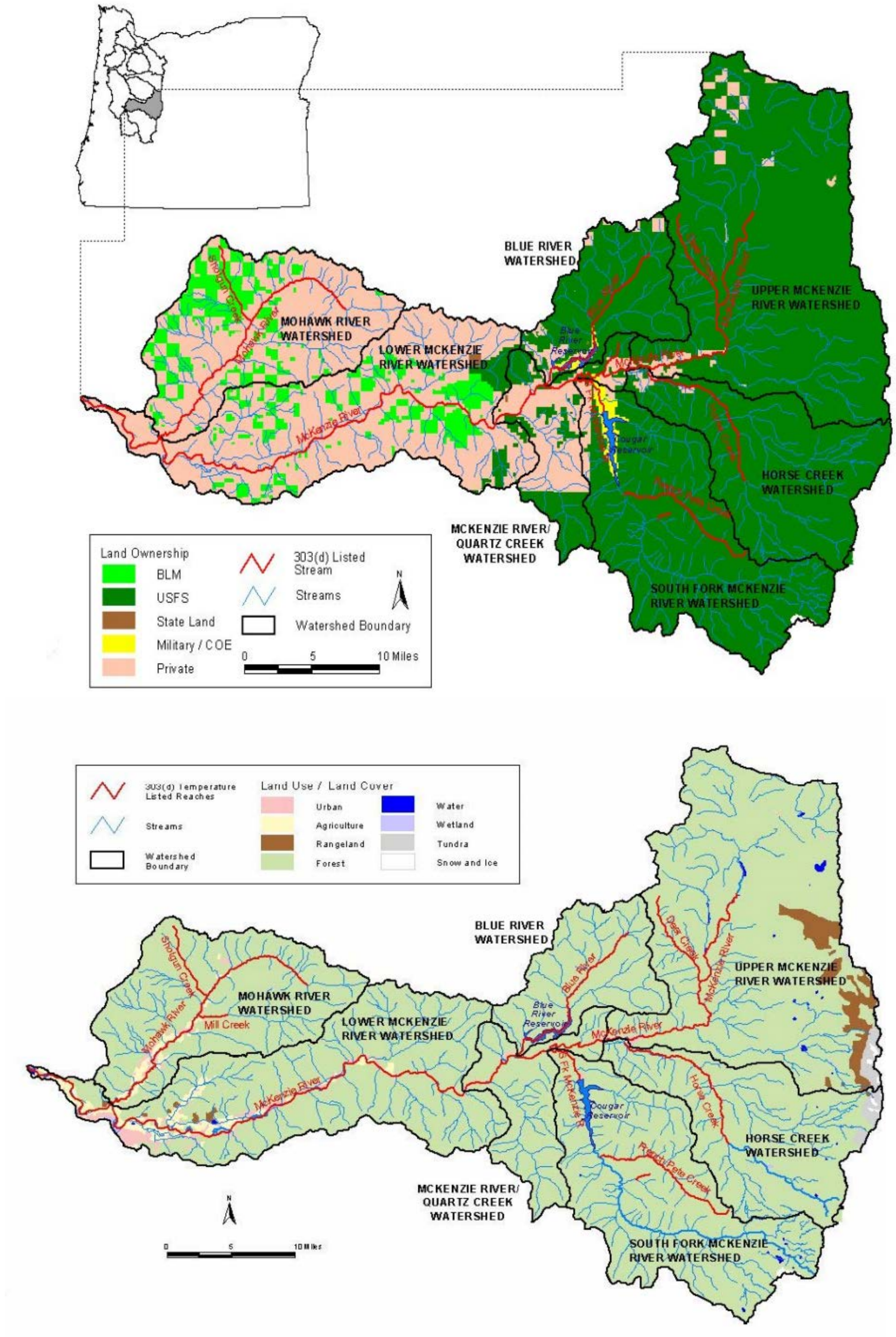

Figure 2. Maps of the McKenzie Sub-basin ownership (top) and of land use (bottom) (ODEQ 2006).

The Corps considered various alternatives for meeting the purpose and need of the Project. This section describes the alternatives screening process, alternatives considered but eliminated from detailed analysis in the EA, and the alternatives considered in the EA.

2.10 Alternatives Considered but Eliminated

The Corps initiated formulation of alternative solutions for meeting the RPA - including downstream passage at Cougar Dam - in 2009, following the 2008 BiOp issuance, as a part of the Configuration/Operation Plan (COP) process. Improving downstream juvenile fish passage at high-head dams is challenging and the RPA only provides limited discussion of this action. The COP applied a science-based decision framework to organize and assess biological, technical, and economic data for the wide range of alternatives under consideration across the WVS to meet the RPA. The criteria agreed on between NMFS and the Corps determined whether the alternatives were: (1) biologically beneficial, (2) technically feasible, and (3) cost effective. The COP primarily utilized cost-effectiveness criteria to prioritize actions across the WVS and screened alternatives for downstream passage at Cougar Dam based on the biological and technical criteria. Appendix D - COP Phase II Alternatives of the COP Phase II Report (USACE 2015) provides a detailed analysis of this screening process (incorporated here by reference). The COP flagged a few alternatives as not technically feasible and did not carry these alternatives forward for detailed biological or technical assessment. For example, subject-matter experts considered fish ladders not technically feasible to achieve fish passage due to associated risks including, but not limited to, temperature issues, head differential, forebay fluctuation, and real estate limitations at Cougar Dam. The COP investigations for Cougar Dam culminated in a Cougar Downstream Passage Engineering Documentation Report (EDR) completed in 2017 (USACE 2017) (incorporated here by reference).

For the EDR (USACE 2017), the Project team developed an initial array of thirty alternatives for providing downstream passage at Cougar Dam. The Corps prioritized consideration of these alternatives for further engineering analysis using qualitative and quantitative evaluations of each alternative against biological, technical, and economic/other considerations. The proposed location for fish collection was a major initial screening tool. Due to results of Research, Monitoring, and Evaluation (RM&E) studies during the COP, the Corps initially concluded that fish in Cougar Reservoir are attracted to the reservoir's cul-de-sac (Figure 3). Studies conducted between 2010 and 2016 provide evidence that fish tend to congregate near the WTCT in the cul-de-sac. These included a January 2010 Pacific Northwest National Laboratory study (Khan 2011) that deployed a DIDSON camera to observe nearfield behavior and relative abundance of fish in the immediate forebay of Cougar Dam. Additionally, in 2012 and 2014, researchers from the U.S. Geological Survey found that fish congregate near the WTCT and when reservoir

temperatures rise, fish tend to occupy the reservoir at the 13° C range (Beeman 2012, Beeman 2014a, and Beeman 2014b). These studies used acoustically tagged fish with an array of hydrophones on the WTCT and in the nearfield area of the WTCT. As a result, the Corps did not prioritize alternatives for the forebay, in-reservoir, or head of reservoir locations (Figure 3) for further study.

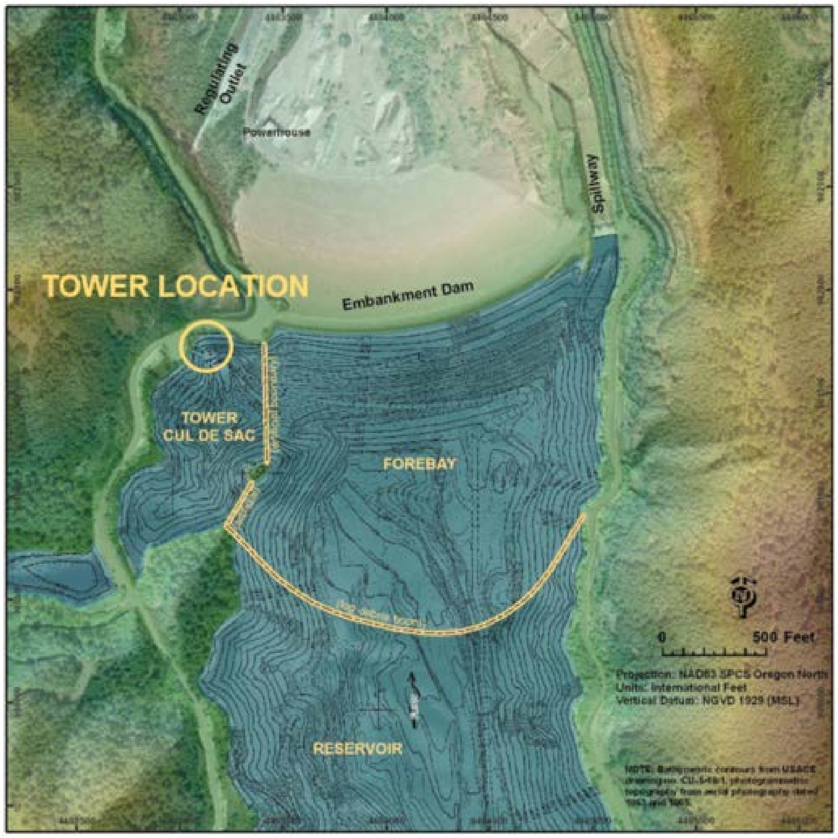

Figure 3. Reservoir Locations for EDR Alternatives.

After the Corps evaluated the initial array of thirty alternatives, the Corps prioritized the structural and operational alternatives summarized in Table 1 for further quantitative analysis. Utilizing technical studies to assess whether the remaining alternatives met the project constraints and biological objectives, the Corps vetted these options down to the two alternatives assessed in this EA. Table 1 summarizes the Corps' screening justification based on the technical analysis described in the COP (USACE 2015) and the EDR (USACE 2017) and summarized below.

Project Constraints

Project constraints represent restrictions that limit the range of alternatives that can be proposed. The following constraints were identified for this project:

1. *Actions will not result in a reduction of the Corps' ability to operate the dam for the flood risk management authorized purpose during construction or over the long term.*
2. *Actions will meet Corps dam safety requirements.*
3. *Actions will maintain the Willamette Project's other authorized purposes (hydropower, recreation, etc.) over the long term.*
4. *Actions will allow the Corps to operate Cougar Dam for temperature control.*

The Corps performed reservoir system modeling using HEC-ResSim and temperature modeling using CE-QUAL v 3.7 to determine if an alternative meets the project constraints, the results of which are documented in Appendix L and Appendix F (respectively) of the EDR (USACE 2017).

Biological Objectives

The fundamental biological objectives used to screen alternatives include:

Objective 1. *The alternative must allow sufficient passage survival so that the above dam sub-population is able to replace itself (i.e. enough adults must successfully return from the ocean and pass upstream of the dam to seed production of the next generation).*

Objective 2. *The alternative must have better fish passage survival than under existing conditions.*

Action alternatives that meet these objectives were included for assessment in the EA. The criteria used to assess whether an alternative meets these objectives is describe below.

The Species Lifecycle Analysis Module (SLAM - developed by the Northwest Fisheries Science Center) is used to estimate and verify whether or not an alternative resulted in population replacement above a dam. Predicted adult abundance estimates were used to evaluate if replacement was likely to be achieved with each alternative. Details on the SLAM tool are included in Appendix C of the COP Phase II Report (USACE 2015). Multiple replacement criteria were checked using SLAM, including:

- The average replacement ratio - above 90% (meets replacement).
- The percent of time the 5-year running average was above 95% - more than 70% of the time (meets replacement).

Alternatives that did not meet these replacement criteria did not meet Objective 1 and were screened out.

The Fish Benefits Workbook (FBW), was used to estimate annual juvenile fish passage survival for each alternative. FBW development was coordinated with regional representatives to ensure the best available data was used, and was also coordinated with SLAM to ensure consistency and compatibility between models. The FBW analysis estimated project survival from the Cougar Dam forebay to tailrace for three individual life history types of juvenile UWR Chinook salmon (fry, sub-yearling, and yearling) under existing and alternative reservoir, discharge, and passage route conditions. Additionally, project specific passage information, including life history divisions (portions of population passing at each life stage), life history timing, passage route efficiency, and passage route survival calculations were included. Details on the FBW tool are included in Appendix K of the COP Phase II Report (USACE 2015) and Appendix H of the EDR (USACE 2017). Alternatives with FBW results similar or lower than the baseline (existing conditions) score did not meet Objective 2 and were screened out.

Table 1. Final Array of Alternatives Screening Summary

Alternative	Screening Decision	Justification for Elimination
Operate as Run of River	Screen Out	Does not meet Corps safety standards. Does not allow the Corps to meet all of Cougar Dam’s authorized purposes.
Use Preferred Outlets (ROs) with or without total dissolved gas (TDG) cap	Screen Out	Did not meet the biological objectives (USACE 2015, USACE 2017).
Pulsing Flow Releases	Screen Out	Did not meet the biological objectives (USACE 2015, USACE 2017).
Operate Below Minimum Conservation Pool	Screen Out	Did not meet the biological objectives (USACE 2015, USACE 2017).
Delay Refill	Screen Out	Did not meet the biological objectives (USACE 2015, USACE 2017).
Floating Screen Structure in Cul-de-sac	Retained	
Floating Surface Collector in Cul-de-sac	Screen Out	Require guidance nets that would not fit in cul-de-sac due to reservoir fluctuation and available space at low pool. Low collection without nets presents high risk of not meeting biological criteria. False attraction could be a big issue with large flows (up to 1000 cubic feet per second (cfs)). Pumped flow may create thermal destratification within the cul-de-sac, affecting temperature management and fish collection.
Weir Box/ Collection Channel with Tower Modification	Screen Out	RM&E studies (e.g., radio tagging and releasing fish to track their movements through the reservoir and dam) have shown that fish swim in and out of tower and have difficulty finding downstream outlets. Pumps with complex internal hydraulics required to attract fish out of tower. Weir box is a much smaller structure and would likely not capture enough fish to meet NMFS requirements.
Trap and Haul	Retained	
Volitional Passage via Piped Bypass	Screen Out	Data are currently insufficient to determine whether volitional high head bypass at Cougar Dam is biologically safe or technically feasible. A high head bypass study is underway to determine if volitional fish passage via bypass is feasible at Cougar Dam. The Corps will evaluate the volitional passage alternatives in a supplemental EA prepared to assess possible environmental impacts of implementation under the following circumstances: • Volitional passage via bypass is determined to be feasible at Cougar Dam as a result of high head bypass study and • Trap and haul is determined not to provide adequate survival by monitoring performed during the first few years of operations.

2.10.1 Operational Alternatives considered but eliminated

The Corps conducted extensive studies examining the feasibility of improving downstream passage through alternative operations - both as an interim measure and as a potential long-term solution. These studies examined dam passage survival of juvenile Chinook salmon using several technologies such as acoustic imaging, high-resolution three-dimensional telemetry, passive integrated transponder tagging and detection to evaluate the survival, movement, and behavior of individual fish, as well as monitoring with screw traps and in reservoir trapping. Population performance was also evaluated using parentage genetics to quantify cohort replacement rate, effective population size, and to assign fish origin (i.e., above or below the dam). The Corps utilized these studies to determine if the operational alternatives met the project biological objectives. Operational alternatives that underwent technical analysis included (described in detail in the EDR (USACE 2017)):

- Run of river operations: The objective is to pass fish downstream through the diversion tunnel by passing flow through the diversion tunnel and lowering the Cougar Reservoir to within 20 ft of lower invert elevation of the diversion tunnel while still providing flood risk management benefits.
- Use of preferred outlets with or without TDG caps: The objective is to pass fish downstream through the RO by maximizing flow through the RO or prioritizing flow through the RO up to the 110% TDG gas cap and otherwise follow existing operations.
- Pulsing flow releases: The objective is to pulse releases of 3,000 cfs held for 2 day durations to move fish downstream from October 15 – June 1, as storage allows.
- Operating below the minimum conservation pool during migration periods: The objective is to pass drawdown Cougar Reservoir to elevation 1,516 ft (minimum Power Pool) in winter (December 1 – January 31) instead of to Minimum Conservation Pool (elevation 1,532 ft).
- Delayed refill of the reservoir: The objective is to pass keep the Cougar Reservoir pool at or below Minimum Conservation Pool (elevation 1,532 ft) through April 30th to allow more direct access to outlets and encourage fish to leave reservoir at the preferred time.

The Corps determined that the Run of River operation, in particular, is infeasible because it does not meet the project constraints. Firstly, this alternative would substantially affect authorized project purposes such as hydropower and recreation. Run of River operations would result in the reservoir going below the elevation of the turbines, limiting or eliminating hydropower production, and make the reservoir inaccessible to water based recreation. Secondly, this alternative does not meet dam safety standards. The Corps designed the diversion tunnel only to pass water during construction of the dam. The Corps did not design the diversion tunnel to be used on a continuous or annual basis and it lacks the proper

infrastructure to allow for required dam safety inspections. Specifically, the Corps is not able to bulkhead off and fully dewater the system for safety inspections and, therefore, the diversion tunnel does not meet Corps safety standards for regular dam operations. The Corps screened out the other operational alternatives based on the biological assessments which showed that these alternatives did not meet the project objectives (USACE 2015, USACE 2017).

2.10.2 Structural alternatives considered but eliminated

2.10.2.1 Floating Surface Collector (FSC) in WTCT cul-de-sac

The FSC structure primarily consisted of a floating barge structure with a pumped attraction flow, dewatering v-screens, and pumped return flow to the reservoir. Fish attracted to the pumped flow would enter the FSC, be screened off with a small percentage of the flow, and collected in holding tanks before being transported downstream. The FSC is similar in concept to the facilities in operation at Upper Baker Dam and Swift Reservoir with the exception that the Cougar FSC barge would only contain the screens and pumps. The FSC requires guidance nets extending from the upstream end of the FSC to the shoreline to meet NMFS requirements. The Corps determined that these nets would not fit in the cul-de-sac due to reservoir fluctuation and available space at low pool. Table 1 summarizes the remaining justifications for eliminating this alternative.

2.10.2.2 Weir Box/Collection Channel with WTCT modification for lower pool operation

The Weir Box Collection System proposed utilizing the existing WTCT weirs to attract fish into the WTCT wet well. Approximately 100 cfs of flow would attract fish into the WTCT wet well over one or both of the existing temperature control weirs above the regulating outlets (RO). A floating structure containing dewatering screens, attraction flow pumps, and bypass flume would then collect fish from the wet well. The fish would then pass through dewatering screens into a separation and holding barge from which the Corps would transport the captured fish downstream. Table 1 summarizes the justifications for eliminating this alternative.

2.10.2.3 Fish Transport

Two fish transport alternatives have been considered for how the fish, once collected, would be moved downstream of Cougar Dam. These include trap and haul (also referred to as truck transport) and volitional passage through a bypass pipe. The Corps already utilizes trap and haul to transport migrating adults upstream from the Cougar AFCF, which the Corps sees as a feasible alternative for fish transport. However, the process of trapping, holding, and transporting the fish can be stressful and recent research on the condition and performance of fish from Cougar

Reservoir (Monzyk 2015 and Herron 2017) have raised concerns about the ability of a system like this to convey fish safely around the dam. In response to these concerns, the Corps is investigating the feasibility of conveying fish through the dam via a volitional bypass pipe. Given that the study is underway and data are currently insufficient to determine whether volitional high head bypass at Cougar Dam is biologically safe or technically feasible, the Corps eliminated this alternative from further consideration for this EA. If volitional passage via bypass is determined to be safe as result of the RM&E studies underway, and the Corps decides to pursue project modification to incorporate it into the Project, the Corps will perform additional NEPA analysis under a supplemental EA to assess the environmental impacts of implementation.

2.11 Alternative 1. No Action

The Corps is carrying forward this alternative for analysis as required by NEPA to provide a comparison of environmental effects between the No Action and Alternative 2. The No Action Alternative would not meet the project purpose and need, since the Corps would take no downstream fish passage actions. The No Action Alternative is inconsistent with RPA 4.12.1 in the 2008 NMFS BiOp, which provides that the Action agencies will, if found feasible, improve downstream fish passage at Cougar Dam. Implementing the RPA in the BiOp helps to ensure the Corps' operation and maintenance of the WVS, avoiding jeopardizing ESA-listed fish species in the Willamette River Basin.

Under the No Action Alternative, the Corps would take no action to address downstream fish passage and the current activities would continue with no changes to the function and operation of the existing Cougar Dam and fish facilities described in detail below. ESA-listed fish species would remain in the reservoir and tributaries upstream of the dam or risk injury and mortality by passing through existing outlets. Since UWR Chinook salmon above Cougar Dam would not be able to reach a level of production and survival to achieve population replacement, release of hatchery-origin adult Chinook salmon would continue to supplement natural-origin Chinook salmon released above the Dam annually. Under the No Action Alternative, there would be no need for a construction staging area, no use of borrow or disposal sites, no construction of access roads, and no improvements at the AFCF: the existing facility and roadways would remain intact. Under the No Action Alternative, the Corps would make no structural changes to the Cougar Dam and AFCF and would continue to operate these facilities as described below.

2.11.1 Cougar Dam and Reservoir

The Cougar Project (Figure 4) began operation in 1963, primarily to manage flood risk as a unit of the WVS. In addition to flood damage reduction, its purposes include power generation;

water supply for irrigation and municipal and industrial use, navigation, fish and wildlife; water quality; and recreation. The 450-ft dam is a rock-fill structure with a powerhouse and concrete spillway including two tainter gates and two slide-gate ROs. The RO and penstock tunnels have a common intake structure in the left abutment. The outlet capacity is 6,000 cfs at minimum conservation pool, elevation 1,532 ft. The power plant consists of two 12,500 kW Francis units run when flow is allowed to move through an intake within the WTCT wet well to the penstock and through conduits which lead to the turbines in the powerhouse located at the toe of the rock-fill dam. A diversion tunnel used during construction of the WTCT is an additional outlet; however, the Corps did not design it for routine use. The Corps typically releases all outflow through the powerhouse and ROs. The spillway is for emergencies only and its use would flood the powerhouse. A 302-foot-high WTCT at Cougar Dam was completed in 2005 to enable dam operators to withdraw water selectively from different reservoir elevations to meet target outflows water temperatures, providing more natural conditions for salmonids in the South Fork and mainstem McKenzie rivers. The Corps completed the new AFCF in 2010 to provide efficient, safe collection, and transport of adult fish (UWR Chinook salmon and bull trout) upstream of Cougar Dam. Existing downstream fish passage is through the ROs and turbines.

Cougar Reservoir is 6.5 miles long at full pool and approximately 330 ft deep near the face of the dam. The reservoir has 54,170-acre- ft of dead storage and 207,970 acre- ft of storage at elevation 1,690 ft (Maximum Conservation Pool). Full pool is at elevation 1,699 ft and stores 219,270 acre- ft with a usable storage capacity of 165,100 acre-feet. This includes 11,300 acre-ft of storage the Corps reserves for summer flood control.

Figure 4. Cougar Dam and Reservoir.

The Corps operates the Cougar Project per the water control diagram in the Water Control Manual (WCM, USACE 1964b) (Figure 5) and conservation season dates in Table 2.

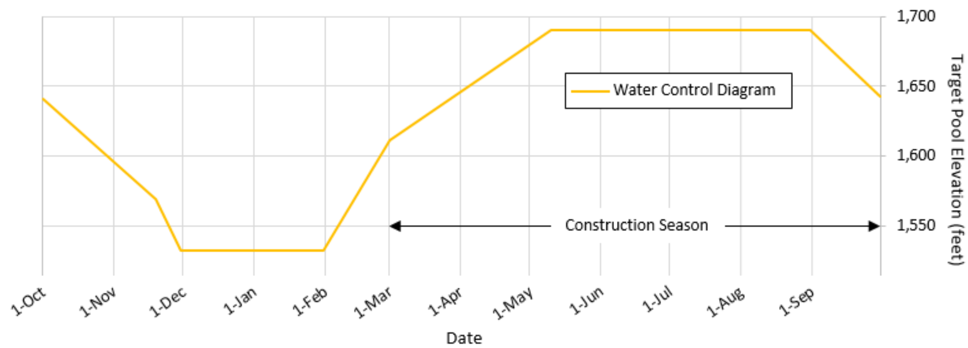

Figure 5. Cougar Dam Water Control Diagram.

Beginning in February, operators allow the reservoir to refill. Beginning in April, the Corps may use this stored water to augment flows downstream for migrating ESA-listed UWR Chinook salmon and for other authorized project purposes. The reservoir may not fill because of stored water release for augmentation purposes. The reservoir is held up to elevation 1,690 feet until 31 August when the Corps begins to draw down the reservoir in preparation for operating for flood risk management. This allows boat ramp usability through summer recreation months, minimizes excess spill (and the resulting TDG), and keeps the outflow around 580 cfs during September, when possible, per RPA 2.4 of the BiOp.

Table 2. Cougar Reservoir Regulation Timeframes

Period of Regulation	Dates	Target Elevation (ft)
Major Flood Control Season	1 Dec - 31 Jan	1,532 – but the reservoir can fill to full pool (1,690) when operating for flood risk reduction.
Conservation Storing Season	1 Feb - 10 May	1,532 - 1,690 – but the reservoir may not fill to full if the water is needed for downstream flow augmentation or if inflow is less than the minimum required outflow.
Conservation Release Season	11 May - 30 Nov	1,690 - 1,532 – but the reservoir is drafted to minimum flood control pool (1,532 ft) in time for winter flood control season.

Error! Not a valid bookmark self-reference. provides the BiOp flow objectives.

Table 3. Minimum & Maximum Tributary Flow Objectives below Willamette Dams (USACE 2007a; Donner 2008)

Period	Primary Use	Minimum Flow (CFS)[1]	% of time flow is equaled or exceeded[3]	Maximum Flow (CFS)[2]	% of time flow is equaled or exceeded[3]
Sep 1- Oct 15	Chinook spawning	300	99.9	580 through Sep 30, when possible	60
Oct 16- Jan 31	Chinook incubation	300	99.9		
Feb 1- May 31	Rearing	300	99.9		
Jun 1- Jun 30	Rearing/adult migration	400	99.9		
Jul 1- Jul 31	Rearing	300	99.9		
Aug 1- Aug 31	Rearing	300	99.9		

[1] When a reservoir is at or below minimum conservation pool elevation (1,532 ft), the minimum outflow would equal inflow or the congressionally authorized minimum flows, whichever is higher.

[2] Maximum flows are intended to minimize the potential for spawning to occur in stream areas that might subsequently be dewatered at the specified minimum flow during incubation.

[3] Flow duration estimates are based on HEC-ResSim model output data for the BiOp operation. Period of Record of model data is Water Years 1936-2004.

2.11.2 Cougar Fish Facilities

The Cougar AFCF was completed downstream of the powerhouse in July 2010 and remains in operation (Figure 6). The Corps designed the AFCF to collect upstream migrating fish (salmon, bull trout, and other resident fish) from the Cougar Dam tailrace and to sort the fish (e.g., separate native and hatchery fish) so that the Corps may transport selected fish above Cougar Dam. This project effectively expands spawning and rearing habitat, and helps restore biological connectivity for migrating fish between upstream and downstream habitats.

There are two primary outflow channels merging about 1,000 feet downstream of the dam (Figure 6). The powerhouse discharges through two generating units and this flow releases into a channel directly downstream of the powerhouse referred to as the North Discharge Channel. West of the powerhouse, the less frequently used diversion tunnel (recommissioned for the construction of the WTCT) also discharges into the North Discharge Channel. The ROs connect to a 13-foot tunnel that discharges up to 12,050 cfs into a plunge pool in a second channel west of the North Discharge Channel, referred to as the South Discharge Channel. The AFCF is located on the east bank of the North Discharge Channel, shown in the red circle of Figure 6.

Figure 6: Aerial view of North and South Discharge Channels at Cougar Dam, showing AFCF Location.

The Cougar AFCF includes the following general features (Figure 7):

1. Fish ladder system
2. Sorting facility
3. Two pump stations
4. Transport truck access roadway and a new access road to the powerhouse
5. Station service upgrades at the powerhouse to support increased power requirements of the fish collection facility; electrical power supplied to the entire AFCF through hydroelectric generators and/or the BPA transmission line
6. Emergency backup power generator
7. Concrete buildings and security fencing
8. Parking lot
9. Rocky stormwater swale

The Corps normally operates the Cougar AFCF beginning in mid-March each year - prior to the arrival of spring Chinook salmon returning to below Cougar Dam - in order to capture any

bull trout residing below the dam that have passed through during winter operations. It operates continuously through October each year unless there is an emergency Powerhouse shut down or another debilitating operational failure. Weekday and weekend operations at the AFCF remain the same throughout the operation season. Following the cessation of spring Chinook salmon spawning activity and their presence below Cougar Dam, the Corps typically takes the AFCF out of service and dewaters in October, undertaking a maintenance period from October to March.

The Corps trucks up to a maximum of 62 fish in the 1500-gallon capacity truck from the AFCF to release sites. Natural-origin fish (identified as not having been produced at a hatchery because their adipose fin is not clipped) collected at the AFCF are trucked on Monday and Thursday for most of the operation period. Toward the end of the operations period, typically around September, the Corps trucks fish Monday through Thursday and occasionally on weekends, depending on fish condition. Typically, the Corps makes only two hauling trips per day: one trip to each of two release sites. The Corps first checks the UWR spring Chinook captured at the AFCF for tags and, if they are not tagged, the operators assume that this is the first time the AFCF has captured these untagged fish. The operators tag, truck, and release these fish at the downstream fish release site located in Blue River, Oregon, just downstream of the confluence of the McKenzie River and the Blue River. The Corps assumes that if these fish are released downstream and return to the AFCF, they originated above the dam and therefore should be tagged and transported upstream of Cougar Dam to their natal spawning habitat. Based on this assumption, the Corps trucks all previously tagged fish collected at the AFCF to the upstream release site located on the South Fork McKenzie River a few miles upstream of Cougar Reservoir at the unimproved Hardrock Campground. The Corps utilizes these release sites because they have adequate truck access and high quality, stable habitat units.

All stormwater collected on site is directed in to two catch basins. In order for the AFCF operators to determine their size and origin of the fish collected in the AFCF, they use the anesthetic tank, located at the end of the flume in the sorting facility, to anesthetize fish. The Corps cannot drain the clove oil anesthetic and water from this tank directly into the river. Therefore, the tank drains into the rocky area across from the generator near the post-sort pool concrete support structure.

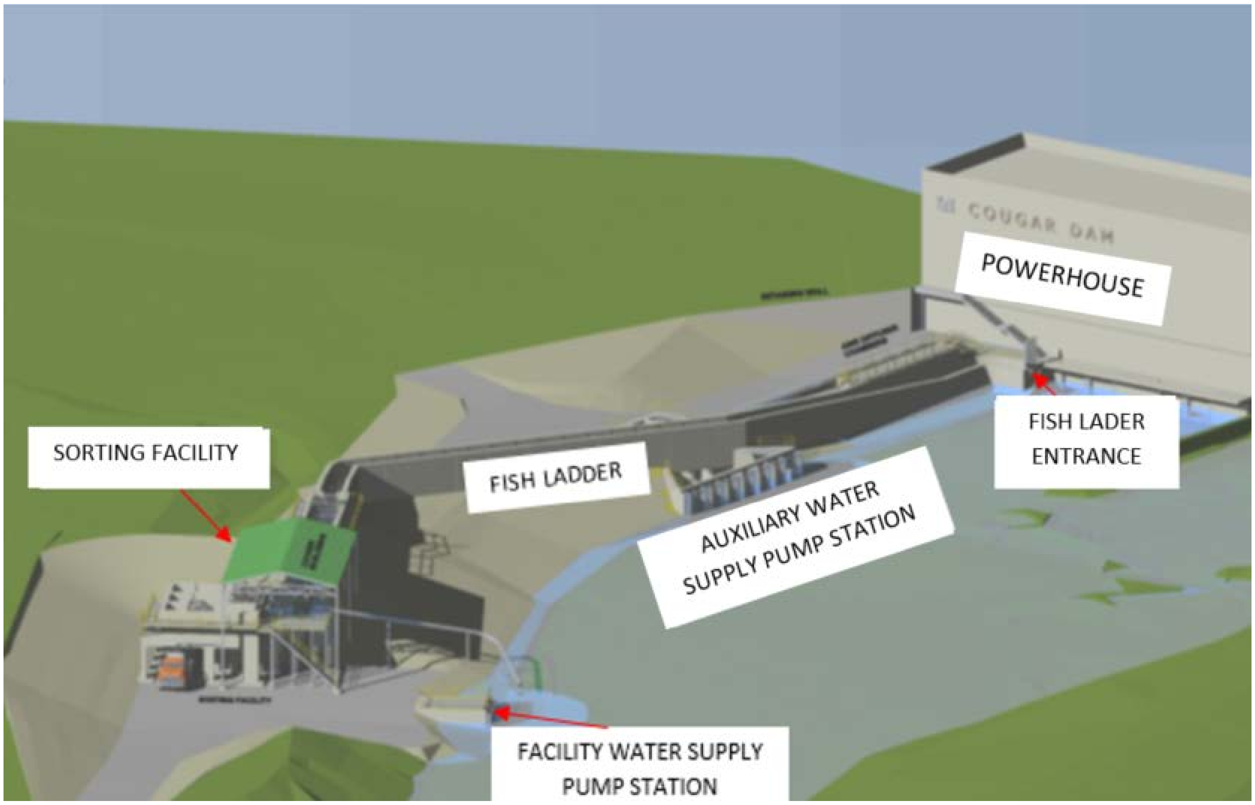

Figure 7. Isometric Rendering of the Cougar AFCF.

2.12 Alternative 2. Floating Screen Structure with Trap and Haul

Alternative 2 is the Corps' proposed action. Under Alternative 2, the Corps proposes to build an FSS to collect downstream migrating fish in the Cougar Reservoir and transport collected fish downstream using tuck and haul. Unlike the FSC (see Section 2.10 for details), the Corps would design the FSS so that flow would be gravity fed, rather than require pumping, in order to reduce operation and maintenance costs and downtime due to pump malfunction. Once collected, the Corps would hold the fish in pods (movable holding tanks) and would transfer these pods onto a transport truck. The operators would drive the pods down to the release site located adjacent to the existing Cougar AFCF and release the fish into the South Fork McKenzie River. If the Corps procures an amphibious vehicle (AV) capable of travelling on both water and land, an AV may be used to transport the fish downstream. Fish would be transported a minimum of one trip per day to a maximum of eight trips per day depending on fish collection numbers. The Corps would release the fish from the AV into the South Fork McKenzie River at a release site located adjacent to the existing Cougar AFCF. Construction of Alternative 2 includes permanent improvements to the road located on the upstream face of the dam as well as construction of the release site on the South Fork McKenzie River located adjacent to the existing Cougar AFCF.

2.12.1 Project Features and Operation

Under Alternative 2, major project components include:

- The FSS with two fish entrances, located as close to the WTCT as possible, leading to two screening systems (which dewater and convey fish to on-board holding tanks and divert screened-off water into gate slot #3 on the WTCT (Figure 8 and Figure 9))
- A mooring truss tower positioned to the east of the WTCT (Figure 8 and Figure 14)
- A retaining wall east of the WTCT (Figure 14)
- Improvements to the AFCF and Powerhouse site to accommodate a fish release site, AV garage, and employee facilities (Figure 23 and Figure 24).
- Continued operations of the Cougar AFCF to collect, transport, and release upstream adult migrants (Section 2.12.8).
- Road maintenance (Section 2.12.8.5)
- Debris management (Section 2.12.8.6)
- Fish conveyance via truck transport
- Flexibility to accommodate volitional pipe bypass (Section 2.12.1.1)

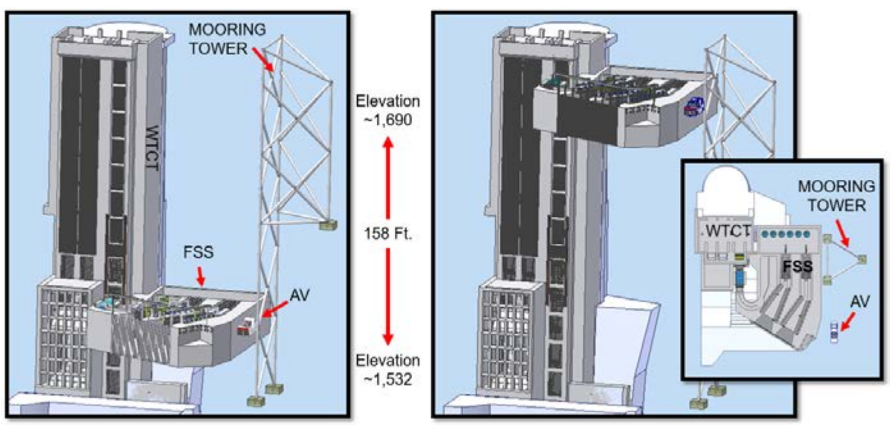

Figure 8. Alternative 2 fish collection components.

The FSS would be designed in accordance with the NMFS Fish Passage Design Criteria (NMFS 2011), USACE Fisheries handbook of Engineering Requirements and Biological Criteria (Bell 1990), and the Surface Bypass Program Comprehensive Review Report (Sweeney et al. 20017). The Corps would operate this system so that the FSS collects fish within the entire range of normal reservoir elevations (Figure 8), and the FSS design would accommodate up to 1000 cfs of gravity flow. The Corps would hydraulically connect the FSS to the WTCT so that when the dam release is 1000 cfs or less, all inflow to the tower would first move through the FSS. Water screened through the FSS would flow into the WTCT's wet well through a hydraulic connection to the WTCT. When dam releases exceed 1,000 cfs, 1,000 cfs would continue to be gravity fed

through the FSS in order to enable fish collection, while the Corps release the remaining unscreened flow through the WTCT (Figure 9).

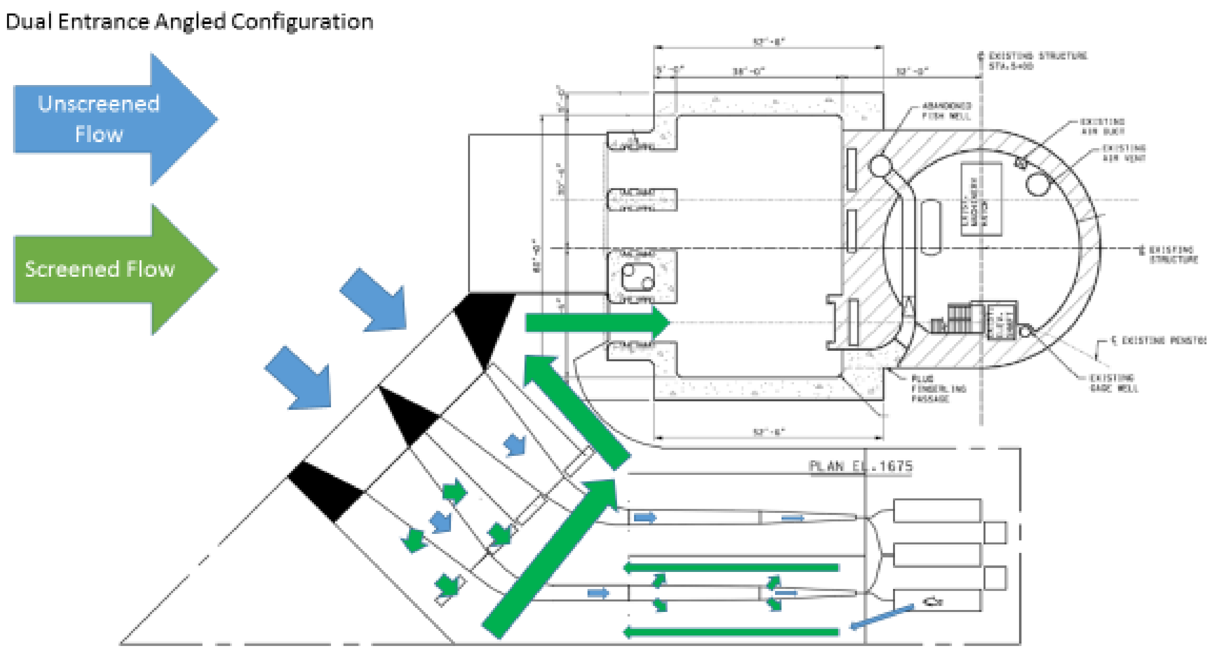

Figure 9. Schematic of flow through proposed FSS configuration.

The FSS would be designed to collect juvenile UWR Chinook salmon specifically; however, the facility would allow other fish species (including bull trout) to enter and be safely held in the trap. The Corps would transport all fish collected in the FSS downstream with the exception of adult bull trout (>350mm), which will be transported downstream from October 1 - February 28 and released at the head of reservoir from March 1 - September 30. Table 4 provides the current plan for fish disposition. Once the FSS becomes operational, the Corps will evaluate fish disposition table and evaluate it yearly with regional fish managers.

Table 4. Fish Disposition

Species	Life Stage	Release Destinations			Sampled Fish			Month of Migration											
		Below Dam	In Reservoir	Head of Reservoir	Below Dam	In Reservoir	Head of Reservoir	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chinook	fry	X[1]			X[1]				X	X	X	X	X						
	parr/smolt	X[1]			X[1]			X				X	X			X	X	X	X
	adult			X[3]								X	X	X	X	X	X		
Bull Trout	70-120	X[1]			X[1]		N/A[3]												
	>120-350	X[1]			X[1]			X	X	X	X	X	X	X	X	X	X	X	X
	>350	X[2]		X[3]	X[2]			X	X	X	X	X	X	X	X	X	X	X	X
Rainbow/ Cuttthroat Trout	fry	X[1]			X[1]		X[3]											X	
	parr	X[1]			X[1]					X	X	X	X			X	X	X	
	adult	X[1]			X[1]														
Montain Whitefish	all	X[1]			X[1]								X					X	X
Longnosed/ Speckled Dace	all	X[1]			X[1]			X	X	X	X	X	X	X	X	X	X	X	X
Sculpin	all	X[1]			X[1]									X					
Non-Native Fish (5)	all	X[1]			X[1]					X	X	X	X	X	X	X	X	X	X

Chinook salmon Notes:
1. All juvenile Chinook will be transported downstream
2. All adult Chinook will be transported to the head of reservoir and released
3. Adult Chinook shouldn't be found in the sub-sample

Bull Trout Notes:
1. Bull trout collected in the FSS and the sample will be transported downstream
2. Bull trout >350 mm collected in the FSS will be transported downstream from 1 Oct - 28 Feb
3. Bull trout >350 mm collected in the FSS will be released at the Head of Reservoir from 1 Mar - 30 Sept

Native Fish Notes:
1. All native fish collected in the FSS will be transported downstream
2. All native fish collected in the sub-sample will be released downstream

Non-Native Fish Notes:
1. All nonative fish will be transported downstream for both FSS collection and subsampling

Inflow to the FSS and WTCT would generate an attracting flow drawing juvenile fish into the FSS. Fish who congregate in the reservoir's cul-de-sac would be attracted into two flumes by the flow through the FSS. This flow would direct the fish into holding tanks at the back of the FSS. At regular intervals, the Corps would transport the holding tanks onto AVs, which would dock alongside the FSS. The AVs would utilize the existing gravel access road along the upstream face of the dam to transport the fish to the downstream fish release site near the powerhouse. Initially, the Corps would operate the FSS 24 hours per day, seven days per week except during maintenance and inspections scheduled annually from July 1 - August 31.

2.12.1.1 Flexibility to accommodate volitional pipe bypass

As discussed in Section 2.10.2.3, the Corps considered and eliminated volitional piped bypass an alternative for fish transport because data are currently insufficient to determine whether volitional high head bypass at Cougar Dam is biologically safe or technically feasible. Trap and haul is a proven technology, and the Corps already uses trap and haul to transport fish upstream of the dam for the AFCF. However, the Corps is currently investigating the engineering and biological feasibility of a volitional bypass system for the Cougar downstream fish passage project. If the truck and haul system proves insufficient to meet survival criteria, then the downstream fish passage project may be modified in future to add a volitional bypass system (a supplemental EA will be prepared to assess possible environmental impacts of implementation). The Corps has considered future bypass features in the current FSS design and provided for flexibility to accommodate piped bypass in future to ensure the Corps can implement this potential modification as efficiently and effectively as possible. For one, excavation along the north/back end of the FSS will provide a generous offset into the existing rock face of 30 ft in order to allow for potential future modifications to the FSS for piped bypass. Additionally, the Corps is designing the FSS with cutouts in the back to accommodate an outlet connection to any future volitional bypass system.

2.12.2 Operations during Construction (i.e., deep drawdown)

The Corps estimates the overall construction period to be approximately 30 months, which includes a 12-month period of deep reservoir drawdown to elevation 1,450 ft. The drawdown is limited in elevation and duration in order to mitigate[2] environmental impacts of the project. Specifically, a drawdown limited to elevation 1,450 ft for a single year duration would minimize

[2] Under NEPA, mitigation includes: (a) Avoiding impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for impact by replacing or providing substitute resources or environments. 40 C.F.R. § 1508.20.

impacts to water quality and endangered and threatened species by limiting the degree or magnitude of the action and its implementation. The EA describes these impacts in Section 3.14 and Section 3.18. Figure 12 shows the proposed construction schedule during the drawdown and the description and duration of each construction activity relative to the reservoir rule curve and drawdown curve.

In the first year of construction during the month of January, the Corps would lower the reservoir from the minimum flood control pool (elevation 1,532 ft) to elevation 1,450 ft using the diversion tunnel. The Corps would maintain a residual pool at elevation 1,450 ft to trap sediments and provide habitat for bull trout (Figure 14). At an elevation of 1450 ft, the area Cougar Reservoir covers is 288 acres and storage is 16,824 acre-feet. Maximum depth below a 1450 ft elevation pool is about 155 ft and average depth below 1450 ft elevation is 58 feet (1392 ft elevation).

The Corps would drawdown the reservoir at a rate of approximately three feet per day in order to dewater the cul-de-sac area while ensuring the stability of the dam embankment (Figure 10). The Corps would also dewater (via pumps) the channel floor in the cul-de-sacand drain the penstock. The Corps would perform fish salvage, where practicable, to remove bull trout, UWR Chinook salmon, and other resident native fish that may be stranded during the drawdown. Finally, the Corps and U.S. Geological Society (USGS) would monitor water quality throughout the drawdown period for water temperature, pH, turbidity, dissolved oxygen, and TDG.

Figure 10. View of dewatered cul-de-sac during 2016 drawdown to elevation 1,450 ft.

During the drawdown, the Corps would regulate the Cougar Reservoir pool between the entrance of the Rush Creek culvert at an elevation of 1,450 ft and the upstream portal to the main diversion tunnel at elevation 1,290 ft. The storage between these elevations should provide some flood protection during construction. The Corps would control large events exceeding the capacity and storage during diversion with the regulating outlet.

The diversion tunnel would primarily pass inflow during the drawdown. Mean monthly inflow is 1,400 cfs in May, 900 cfs in June, and less than 400 cfs from July - September; however, most of the flow is concentrated from a few storm events. The Corps would maintain the flood control function of Cougar Dam during the drawdown. During summer floods, construction would cease any time the Corps predicts reservoir levels to go above an elevation of 1,450 ft. The Corps would release floodwaters via the diversion tunnel at a maximum of 2,000 cfs and drawdown the lake so that construction could resume. The Corps would maintain the drawdown through December of the first year of construction, even during the normal flood control season (October - March). The Corps would keep the Cougar Reservoir pool as low as feasible without increasing downstream flooding from October through December of the first year of construction. Starting in January of the second year of construction, the Corps would allow the reservoir to fill to the minimum flood control pool (elevation 1,532 ft) and normal operations would proceed with filling of the conservation pool beginning in February.

The drawdown is limited to one summer to minimize impacts to ESA-listed species. The drawdown would begin in January of 2021 and must end in December of 2021 to improve the

probability of reaching a full pool during summer 2022. Maintaining flood control operations to store water meeting downstream flood control obligations may flood the construction site. In December 2021, normal operations would resume and the reservoir would begin to refill to its normal rule curve, which is elevation 1,532 ft in January and a targeted maximum elevation of 1,690 ft by June.

To facilitate the FSS launch, the reservoir pool elevation must rise above the level at which the collector is constructed. The maximum pool elevation realized during refill is dependent upon the natural inflows to the reservoir during the refill period and how the Corps manages that water. Figure 11 shows the probability of the pool remaining below each elevation (the non-exceedance probabilities) during the refill period immediately following the 1,450-foot drawdown.

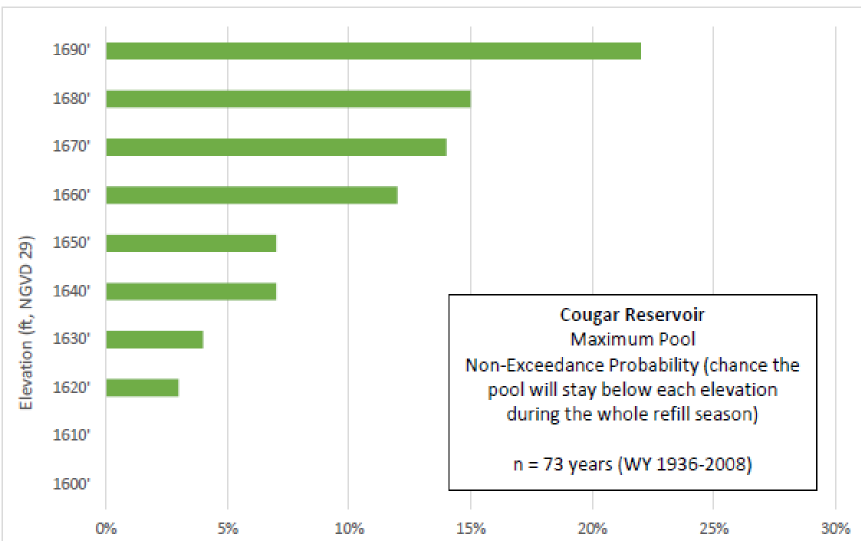

Figure 11. Non-Exceedance Probability of Maximum Pool.

The simulation based pool elevation non-exceedance probabilities on reservoir regulation simulation model (HEC-ResSim) outcomes. Seventy-three years of operations, including drawdown to 1,450 ft followed by subsequent refill, were simulated using historical hydrology from 1936 to 2008. Drawdown and refill is consistent with the proposed construction schedule. The Corps conducts reservoir operations for hydropower, flood risk management, and environmental and biological functions. The simulation assumed that the Corps would prioritize refill such that the Corps could use Cougar Reservoir to meet BiOp minimum flow requirements at Salem and Albany; however, the simulation maintained local BiOp requirements for outflow ramping rates and minimum flows. Following construction and refill, Cougar Reservoir would continue normal operations and FSS impacts of operation would be the same as those under the No Action Alternative

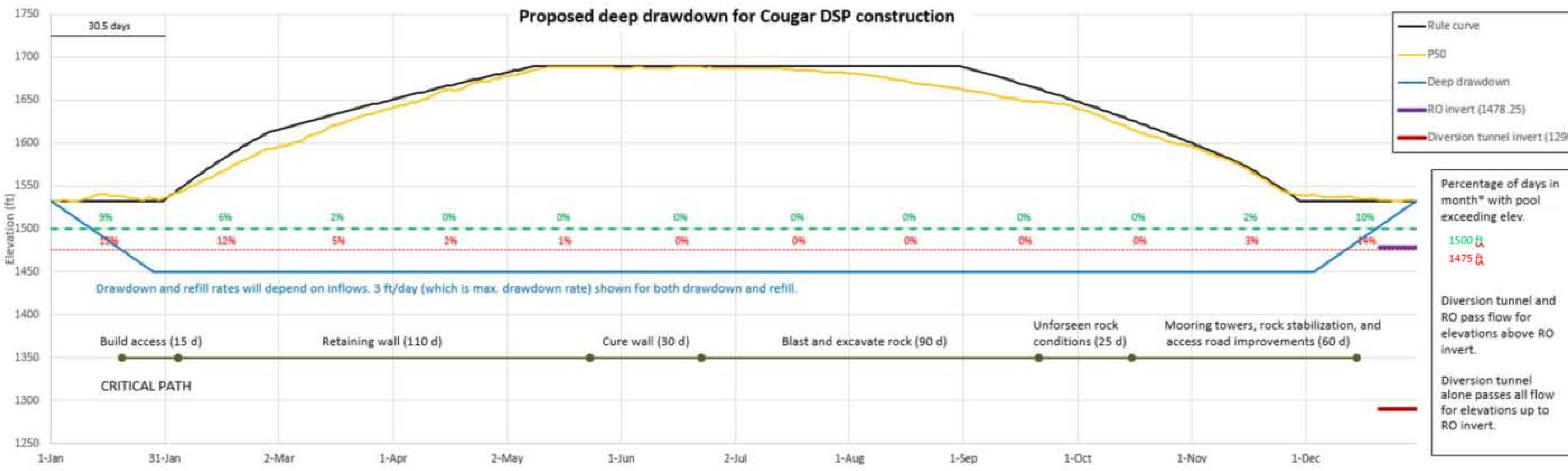

Figure 12. Deep drawdown construction schedule.

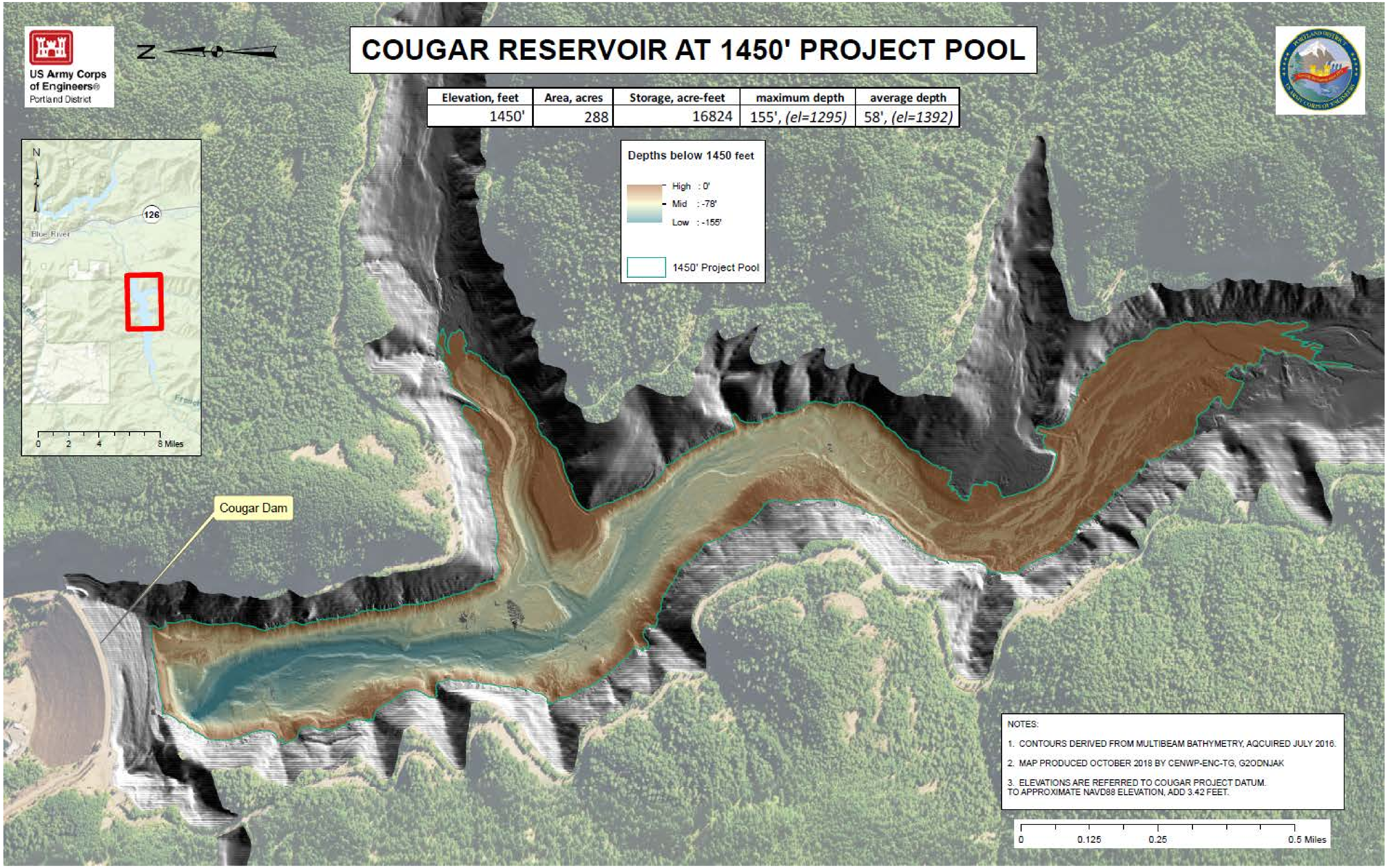

Figure 13. Drawdown to elevation 1,450 ft.

2.12.3 Construction during the Drawdown

Figure 14 shows the components of Alternative 2 proposed for construction during the deep drawdown of Cougar Reservoir and the EA provides a description below.

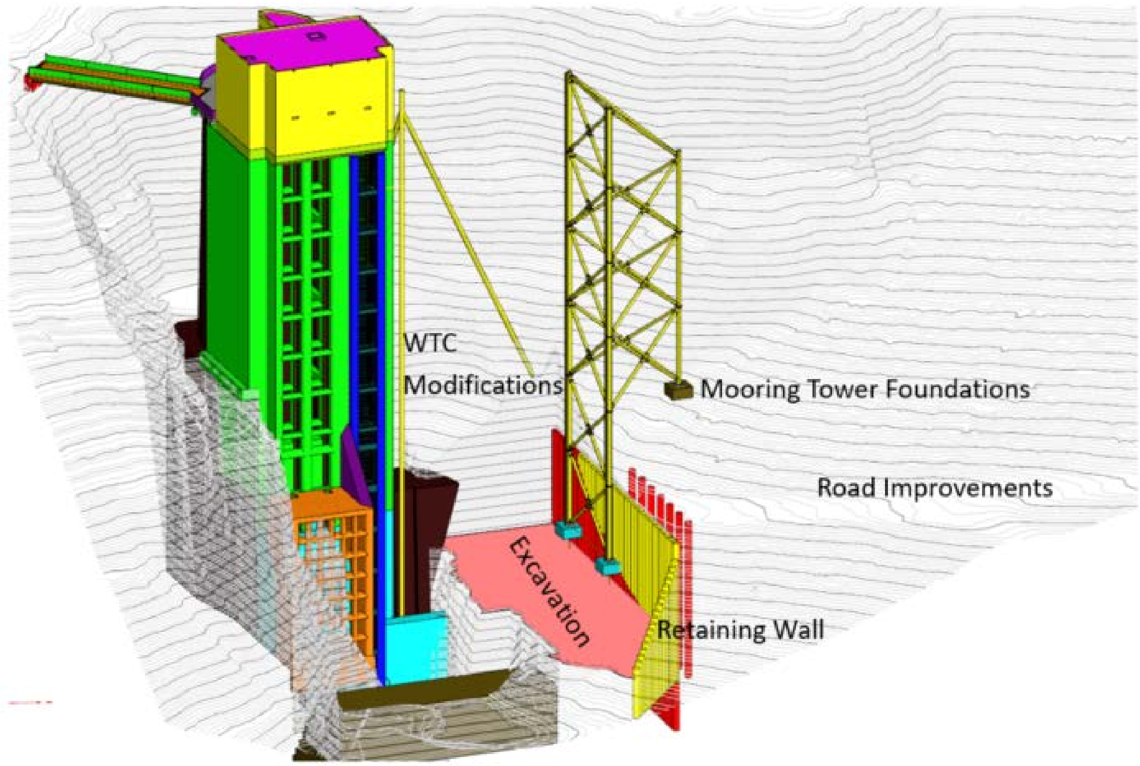

Figure 14. Alternative 2 components constructed during the deep drawdown.

2.12.3.1 Rock Slope Scaling

The Corps has not maintained the rock slopes for over 50 years. Because at least two people would occupy the proposed FSS during the collection period, all slopes above the FSS would undergo rehabilitation/maintenance. Figure 15 details the area the Corps would rehabilitate.

Figure 15. Rock slope protection above the proposed FSS.

Rehabilitation work consists of rescaling slopes to remove all loosened rocks, adding rock bolts where necessary, and meshing to improve the safety of people working below the slope. Rock scaling will follow standard requirements and practices by the Oregon Department of Transportation (ODOT). Since people will be routinely working below, the slopes may require periodic routine visual inspection and maintenance at intervals of 10 to 20 years or when required.

2.12.3.2 Rock Excavation and Reinforcement

Accommodating the FSS at low operating pools would require excavation into the large dacite rock feature at the left abutment of the embankment. Figure 14 shows the proposed rock excavation. Excavation would be performed from the top down after a retaining wall has been constructed, described in the following section. The Corps anticipates the rock and overburden excavation to produce approximately 15,000 cubic yards of rock. A bulking factor of 1.4 requires 21,000 cubic yards of disposal area. The Corps would blast, mechanically remove, and place in the reservoir the material proposed for excavation and use some portion of it to improve the road on the upstream face of the dam (Figure 16). As the Corps excavates the rock, permanent reinforcement would be installed, which would include a combination of patterned rock bolting, rock meshing, and rock fencing. Rock reinforcement design would follow EM 1110-1-2907 and ODOT standards.

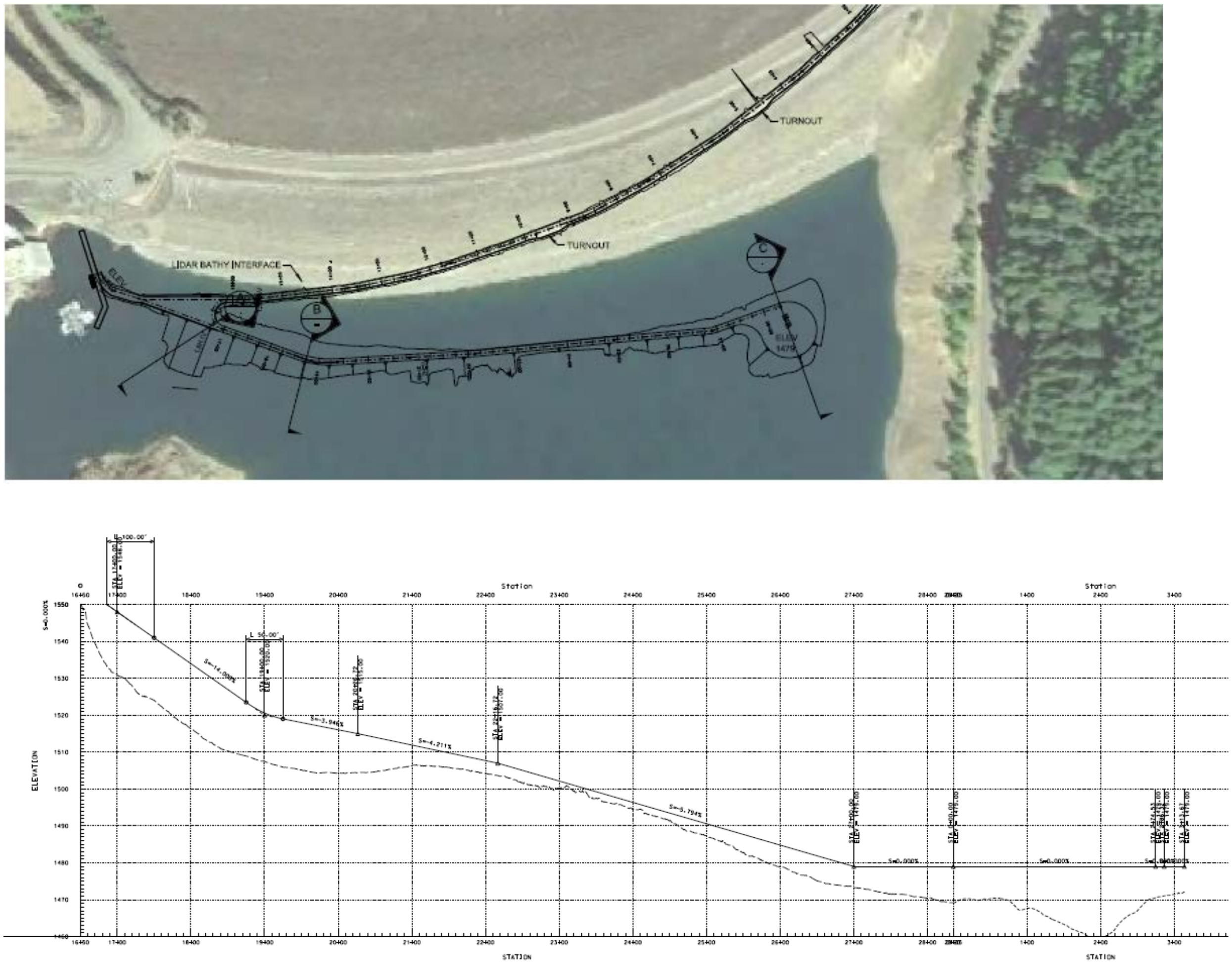

Figure 16. Excavated material placement- plan view and cross section shown.

2.12.3.3 Retaining Wall

The width of the FSS would require the Corps to remove a saddle of rockfill shell material. Underlying this saddle is a natural bedrock-retaining feature that the Corps would also remove. Figure 14 shows the location of the retaining wall. Because the Corps would remove the natural bedrock buttress, the Corps would construct a structural wall to retain the rockfill shell along the embankment during the drawn down. The wall would consist of steel cased tangent piles embedded 30 ft into bedrock. A second row of discrete piles 10 ft offset from the main wall would allow for tieback beams that would minimize side wall movement.

2.12.3.4 Mooring tower foundations and lower structure

The FSS would require mooring on three points along the structure to limit horizontal movements. The Corps would moor the west side of the FSS to the existing WTCT and the east side of the FSS to a steel frame structure supported laterally by connection to rock anchors in

the east rock slope (Figure 14). A third mooring point would be located along the north rock wall. The mooring structure would extend 160 ft above ground in order to accommodate the FSS at all reservoir levels via movable connections or rails. Foundations would consist of shallow spread footings anchored into competent rock or single discrete drilled shafts drilled into competent rock.

2.12.3.5 Temporary and permanent improvements to the road on the face of Cougar Dam

The project would use existing access road along the upstream face of the dam for construction access. After construction is complete, the Corps would use the road daily during operations for debris management as well as crew and fish transport. As a result, the access road would require rehabilitation to accommodate the increased traffic loads.

The existing roadway consists of a 15 to 20 ft width gravel haul road (Figure 17). The proposed roadway improvement under Alternative 2 would extend from the top of the dam down to the minimum conservation pool elevation of 1,532 ft (Figure 16). Fish transfer operations would not occur below elevation 1,532 ft. Roadway improvements would include adding partially buried Jersey barriers to the existing gravel roadway. The barriers would be spaced periodically to allow water free runoff between the barriers and include 8-foot-high (snow) post markers to delineate road edge. The Corps would widen the gravel surfacing in a few areas to facilitate debris removal. The widened areas would allow a dump truck to park at an angle to facilitate an excavator loading log debris into the bed. The Corps would replace the existing gravel road surface with crushed surfacing. The Corps would pave any areas with sharp turns such as at the switchback to prevent rutting and protect the side slopes with riprap. The surface of the roadway would be finished with a V-groove pattern (typical of boat launches) for traction.

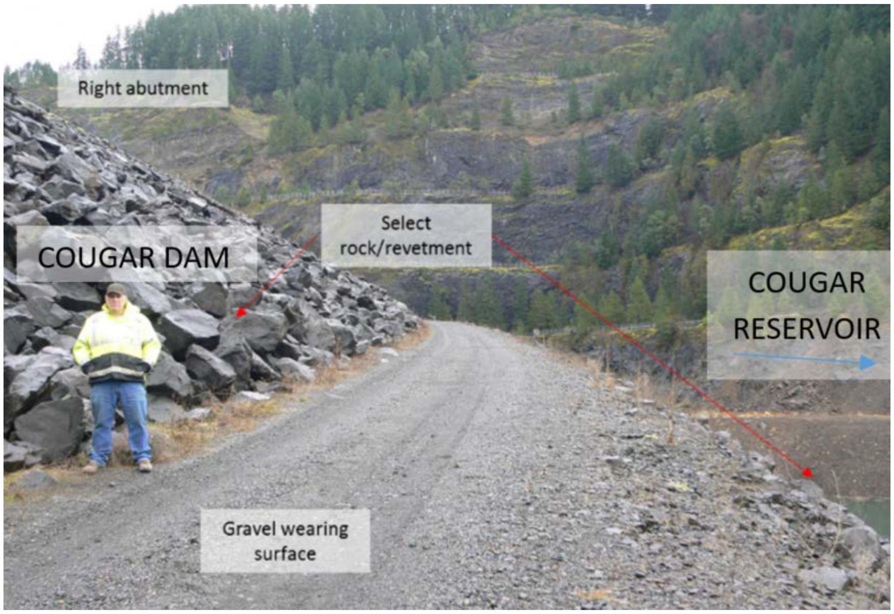

Figure 17. Upstream Access Road- East view.

2.12.3.6 Rush Creek Trashrack and Routing

Rush Creek enters Cougar Reservoir upstream of Cougar Dam through an existing culvert under Aufderheide Drive (Figure 18). Two debris screens, located on a concrete headwall, allow water to flow into the single culvert. Currently, there is evidence of erosion around and under the culvert and trash racks. This is a U.S. Forest Service (USFS) culvert and the USFS may repair it. However, the Corps does not consider this repair as essential for the success of the project; therefore, the Corps does not consider the work on the culvert and trash racks a part of this alternative.

During the drawdown, Rush Creek would channelize within the reservoir downstream of the culvert at Aufderheide Drive and enter the reservoir Forebay through a second culvert located at the saddle between the WTCT and the larger Forebay (Figure 18). The Corps would clear soil and debris to keep the creek flowing into this second culvert along the left bank away from the tower (Figure 19).

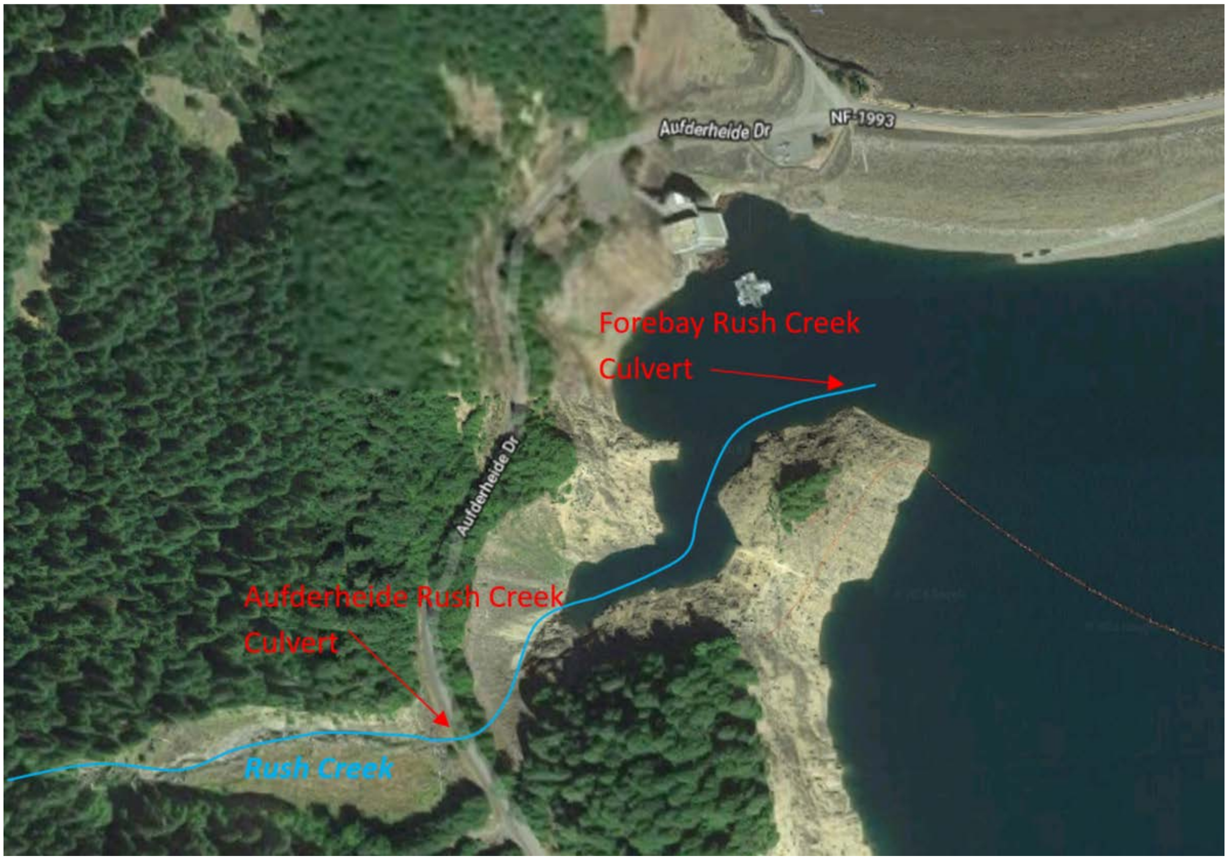

Figure 18. Rush Creek culverts into Cougar Reservoir.

Figure 19. Rush Creek during 2016 deep drawdown.

2.12.3.7 FSS Assembly Construction Pad Construction

The construction process of the FSS involves the following tasks:

- Prefabricating the FSS modules at a fabrication facility
- Hauling the FSS modules over public and USFS access roads to the assembly site
- Earthmoving to clear, grub, and construct a level pad large enough to include the FSS, access for equipment around the FSS, and storage
- Transporting the prefabricated modules and materials to an area on the reservoir shoreline below the ordinary high water mark in order to launch the FSS like a boat when the Corps raises the reservoir as part of normal dam operations
- Assembling modules at the construction site
- Launching the FSS using towboats to move the FSS to the operating location
- Mooring the FSS in the cul-de-sac
- Connecting the FSS to the WTCT
- Final outfitting at the operating location
- Removing the pad and restoring the area to pre-construction condition

The Corps considered two sites for FSS assembly: the Slide Creek boat launch area and the North Sunnyside area (Figure 20). The Slide Creek boat launch, located upstream of the dam on the east side of the reservoir in an area with an active campground, is accessible via the west reservoir road. The site is sloped and accessible by conventional construction equipment via the existing campground roads and boat launch. The North Sunnyside area, also gently sloped and adjacent to the NF-500, is south of Slide Creek and north of Sunnyside Campground.

During the drawdown, an area approximately 3 acres below the ordinary high water mark would be leveled to create a flat construction pad for assembling the modules. On the east side, a cut slope of 1-to-1 would begin at elevation 1,685 ft and be excavated down to an approximate elevation of 1,662.5 ft. The Corps would move material from the excavation area towards the reservoir to fill the area and develop a level pad below elevation 1,662.5 ft. The reason for starting the cut slope at elevation 1,685 ft is to keep the pad construction within the high watermark of the reservoir at elevation 1,690 ft and below the tree line. The cut/fill option would utilize 30,000 to 40,000 cubic yards of material. This would require the construction crew to haul in a minor amount of off-site material. The reservoir elevation is typically up to 1,690 ft until August 31st. Within 30 days, by mid-September, the reservoir level would drop down to elevation 1,650 ft, allowing for the construction of the FSS construction pad to begin before the end of September and ready to receive deliveries of modules and equipment as soon as prefabrication proceeds and shipments can begin. This construction would take one to two months with completion before winter. Figure 22 shows what the constructions staging site

would look like if constructed at Slide Creek. The drawdown schedule provides a dry pad for approximately 19 months in which to complete most construction activities prior to launch.

If built at Slide Creek, the Corps would build a construction pad over the existing boat ramp. The Corps has not identified the exact site for North Sunnyside; however, the proposed construction pad specifications are the same as those proposed for Slide Creek. The pad would be in place until the Corps raises the reservoir to elevation 1,690 ft and floats the FSS to the WTCT for installation. The pad would remain in place until the next reservoir drawdown period in September. At that time, the Corps could remove the pad by excavating the fill portion of the pad and pushing or loading and hauling the materials back up the slope, putting the area back into the pre-construction condition. Alternatively, the Corps could maintain the pad for future emergency dry-docking of the FSS for repairs and maintenance. In either case, the Corps would restore the boat ramp road to provide boat access at the Slide Creek Campground in future, if Slide Creek is the chosen site.

To use of either Slide Creek or North Sunnyside Staging areas, the Slide Creek Campground may be closed to prevent access to the construction site and for the use of the Slide Creek Campground facilities by contractors (camping trailers, pit toilets, water well, etc.). Staging area construction may also require the modification of the hand pumped water well and the water capacity available through the well. Although not anticipated, changes to existing pavements may be required.

Figure 20. Potential FSS Assembly Staging Sites (images from Google Earth).

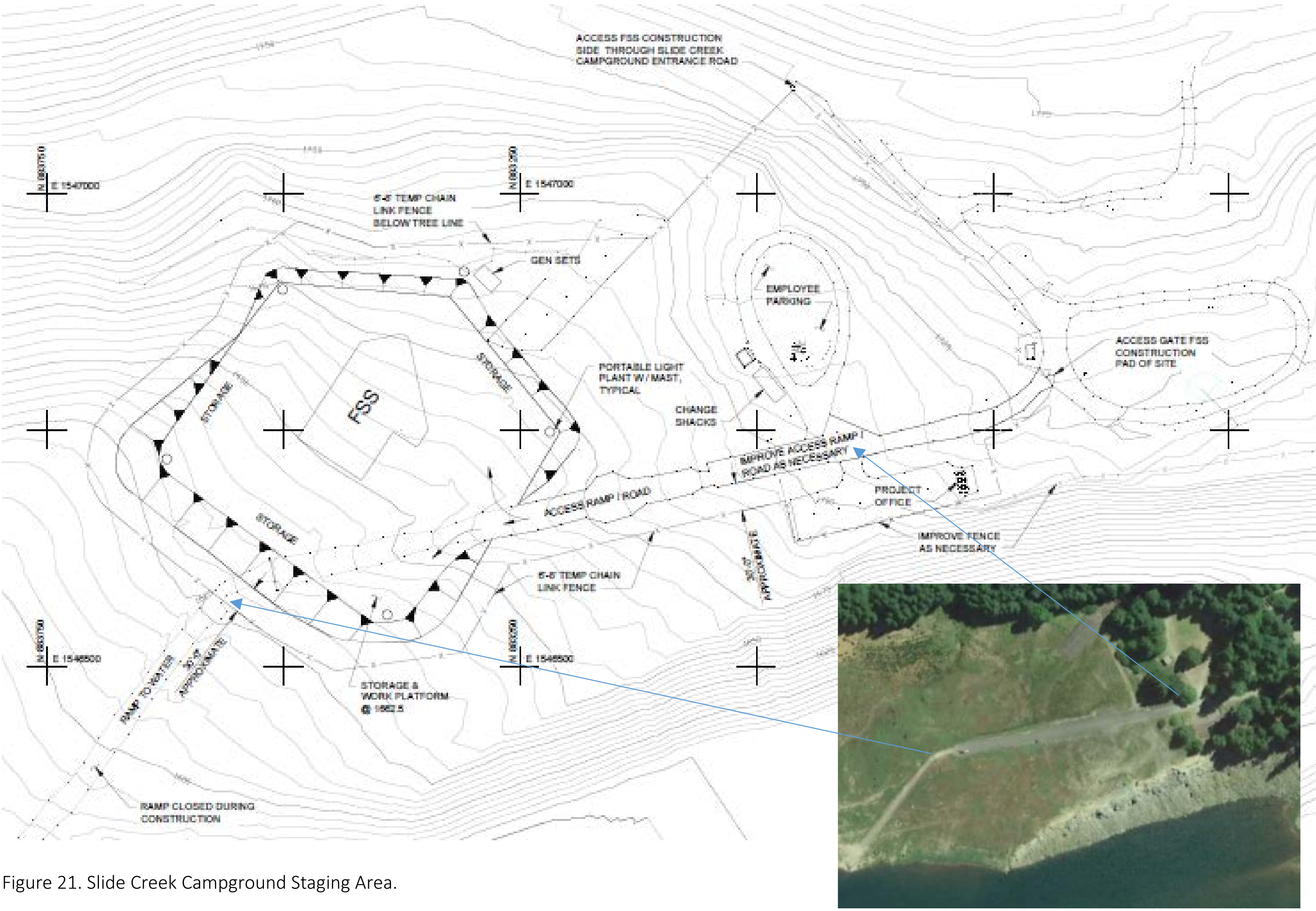

Figure 21. Slide Creek Campground Staging Area.

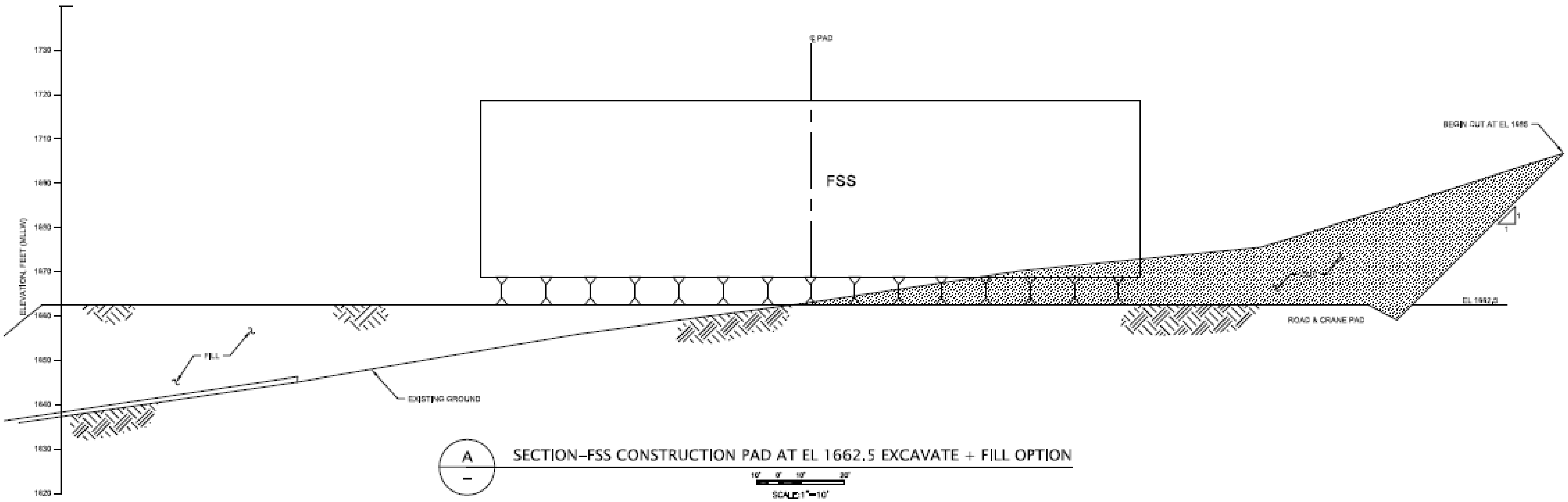

Figure 22. Slide Creek Staging Area proposed cut and fill.

2.12.4 Fish Release Site Improvement Construction

The Corps would make improvements to the AFCF area to accommodate the release of fish collected at the FSS by a transport truck including improvements to the following: access roads, surface drainage, water supply and flume at the AFCF, and powerhouse site improvements. The EA describes these improvements below. Figure 23 shows the improvements localized at the AFCF.

Figure 23. Fish Release Site Plan.

2.12.4.1 Surface Drainage

The Corps would make improvements to stormwater and drainage systems at the fish release site. The Corps constructed the existing AFCF with a paved lot that includes two catch basins. These basins collect stormwater and runoff from the fish transport trucks that occurs during fish transfer activities. The AFCF also includes an overflow drain that connects to the catch basin in the parking area. Concrete pipes connect the two catch basins, which drain into the river. The storm catch basins and conveyance system appear to be undersized, as they overflow regularly during fish transfer operations. This overflow is responsible for undermining the base rock (cracking) in several locations around the asphalt aprons. Alternative 2 proposes repairing the damaged sections of pavement by removing damaged areas and rebuilding the subbase and base, then repaving. The proposal is to contain water on the pavement with curbs and curb cuts to convey surface water flow out at the low point along the river edge (west edge) from fish handling operations (Figure 23). The area on the east, west, and north sides of the pavement apron would have a curb installed to prevent fish transfer water from running off the pavement and undermining the pavement during fish transfer operations (Figure 23).

2.12.4.2 Fish Release Water Supply and Flume

The Corps would install a new pump and tank at the release site so that there is water supply for fish release operations completely separate from that of the AFCF. The operators would utilize this water supply to rinse out the fish tank at the fish release site,ensuring all fish make it out of the tank, removing any remaining debris, and possibly allowing the operators to bring the truck water temperature within 2° C of the fish release site water temperature. The Corps would install powerhouse area site improvements.

If the Corps utilizes an AV for fish transport, improvements at the powerhouse site would likely include the construction of a garage to house the AVs (Figure 24). At the time of this EA, the final dimensions of the AV have not been determined. The arrangement shown in Figure 24 assumes a garage with fours stalls and a 12-ft by 30-ft parking area. The garage size would be refined in plans and specifications, along with any stormwater pond/dispersion sizing. There appears to be ample room for dispersion/infiltration from the garage.

Figure 24. Powerhouse Area Site Improvements.

2.12.4.3 Construction Staging

Staging areas used to stage equipment and materials and access the site would be available at several locations (Figure 25). The powerhouse has a large fenced area with more than two acres that are available for staging as needed. There are parking lots next to the spillway and the WTCT, which combined can provide approximately 0.5 acres for construction trailers or equipment staging.

Figure 25. Staging Areas (in yellow).

2.12.5 Construction Access

The Corps accesses the top of the dam and the WTCT from Aufderheide Drive (National Forest Road (NF)-19) via Oregon State Route 126. The Corps can access the AFCF, powerhouse and downstream fish release (proposed under Alternative 2) site can from National Forest Road 410 (NF-410). It is located behind a security fence with a gate. Since the dam's powerhouse is within the fenced area, the Corps would be able to maintain security during construction. Construction traffic between the release site/lower staging area and the top of the dam can also travel along a switchback alternate access road (referred to as the quarry road) that is located alongside the emergency spillway (Figure 26). The quarry road would require minor clearing and grubbing, some rehabilitation and improved stormwater controls along the lower portion, and widening and paving along the two switchbacks and guardrails along the upper portions. Any new impervious surface would require stormwater management measures as well.

Figure 26. Alternative access (in yellow) to fish release site.

The Corps can most easily access the Slide Creek Campground and the North Sunnyside Staging Areas by taking Aufderheide Drive around the west side of the reservoir. The roadway is paved with asphalt and includes a section of gravel road located north of Terwilliger hot springs that is approximately a half-mile long. The asphalt pavement ends after passing over the bridge at the southern end of the reservoir. The gate to the Slide Creek Campground is approximately one mile from the bridge and the North Sunnyside area is accessible from an existing unpaved roadway along the river beginning at the bridge. The Corps can also access these staging areas by driving NF-500 around the east side of the reservoir. NF-500 is narrow (approximately 10-12 ft wide) and unmaintained. Temporary security fencing or other security measured would be required around construction areas that are normally open to the public.

2.12.6 Construction Traffic

The Corps anticipates an average of one semi-truck of material or equipment per hour for eight – ten hours per day, up to sixteen-hour days during the summer drawdown work. For the 30 months construction duration there would also be ten – thirty daily passenger vehicles for the workers. Construction traffic and haul roads would be in compliance with the Corps of Engineers safety manual, EM 385-1-1. This manual specifies use of the “Manual of Uniform Traffic Control Devices” for highway construction signage. The contractor’s traffic safety plan would address construction traffic entry and exit points onto public roads and traffic control into the site.

2.12.7 Temporary Environmental Controls

Under Alternative 2, the Corps would implement erosion and sediment control Best Management Practices (BMPs) to stabilize exposed areas and contain runoff, such as the installation of silt fencing to prevent sediment from construction activities entering wetlands or the surrounding water bodies. BMPs will collect stormwater and remove sediment before the stormwater returns to the reservoir or river. The Corps would mulch disturbed work areas and cover inactive material stockpiles during rains that produce runoff. If the Corps holds any disturbed ground and stockpiles over the winter, the Corps will protect them with fiber-bonded mulch or similar methods to prevent erosion. The Corps would maintain and replace these sediment and erosion control measures as necessary until construction is complete and permanent vegetation and storm runoff control measures are established and effective.

Other BMPs that will likely be implemented include containment of equipment fueling areas and locating these areas as far from wetlands or waters as possible to prevent discharges in a spill event. Daily inspections of the fueling area and construction equipment will occur to ensure there are no leaks. The Corps would place oil-absorbing pads, drip pans, or similar devices beneath the equipment when working in waters or staged overnight to catch any leakage. Fuel spill control devices, such as a Wiggins Fast Fuel system or equivalent, will be used. The Corps will substitute equipment hydraulic fluids with biodegradable fluids as appropriate. Special construction measures will be required when working above/near water to prevent pollutant discharges. The Corps will restore areas disturbed during construction to existing conditions upon the completion of work unless stated otherwise in the drawings and specifications

The Corps would procure a NPDES Construction permit from the Oregon Department of Environmental Quality (ODEQ) to address stormwater discharges from construction sites of one acre or more. As a part of that permit, an Erosion and Sediment Control Plan (ESCP) would be prepared before construction begins. The ESCP will be prepared in accordance with ODEQ guidance (ODEQ, 2013a and 2013b). The ESCP describes the measures, including BMPs, implemented during construction to control erosion, prevent sediment discharges in stormwater, and minimize the potential for hydrocarbon or chemical contamination of site soils and water bodies. The ESCP will address all areas of disturbance from the construction activities, including equipment staging, material stockpiling, and the concrete batch plant. The contractor must comply with all conditions of the permit and implement the ESCP. The Corps will keep the ESCP on the site and it will be updated as needed.

2.12.8 Operations

2.12.8.1 FSS Period of Operations

The Corps would operate the FSS to collect fish from January 1 to June 30 and September 1 to December 31. From July 1st - August 31st, fish collection would cease and the FSS would undergo annual inspection and maintenance (see Section 2.12.8.3 for details). The reservoir temperatures and the known fish depths during elevated reservoir temperatures indicate that the 25-ft deep FSS entrance would limit the number of fish collected. The warmer periods of the year, when fish are less likely to pass, provide the perfect opportunity to conduct maintenance on the FSS. During fish collection season, the FSS would operate seven days per week, 24 hours per day. The FSS would operate (i.e., collect fish) over a range of reservoir elevations from 1,528 to 1,690 ft. If the Corps expects the reservoir to increase above elevation 1,690 ft or decrease below elevation 1,528 ft, the Corps would shut off and hydraulically disconnect the FSS from the WTCT. If the pool drops below elevation 1,528 ft but stays above elevation 1,516 ft, the FSS would be de-ballasted into the maintenance position to avoid hitting the bench elevation of 1,490 ft. If the pool drops below elevation 1,516 ft, the Corps would disconnect the FSS, move out of the cul-de-sac into deeper water, and secure it. If temperatures exceed 21° C, which is the 2008 BiOp sampling limit, the Corps would shut off the FSS, stop fish collection, and halt transport. This temperature criteria may increase or decrease the period of operations.

Operations of the FSS during an emergency would depend on the emergency. In the event of power failure, the FSS backup generator would supply enough power to the ballast pumps, emergency lighting, and communications infrastructure. The Corps would hold fish on the FSS for 24 - 48 hours following a power outage, supplying fish with flow through water. If the Corps anticipates the power outage to last longer than 48 hours, FSS personnel would manually remove fish from the holding tanks and transport the fish to the release site below Cougar Dam. If transportation were not an option, FSS personnel would release the fish into the reservoir.

2.12.8.2 Downstream Fish Transport and Release

Separation bars in the FSS would sort the juvenile and adult fish into dedicated juvenile and adult fish pods, respectively. The separation bars, located in the screening section of the FSS upstream of the pods, are spaced so that only fish of a certain small size can move through to access the juvenile fish pods. The Corps would be able to lift these pods from the fish sorting area via a transport monorail and load them onto a transport truck or AV for transport to the release site located in the AFCF area. If the Corps utilizes an AV, the AV would access the FSS by driving down the dam access road on the upstream side of the earthen dam, out into the reservoir, and across to the FSS. After docking in the AV slip at the FSS, the fish transportation

system described above would deposit the fish pod onto the cargo area of the AV. The AV would then travel back across the reservoir, up the dam access road, and down to the fish release site below Cougar Dam. The Corps would provide two AVs for the transportation of fish and crew in order to guarantee continuous operation of the FSS.

2.12.8.3 Downstream Fish Passage Facility Maintenance and Inspections

The established maintenance period for the FSS would be from July 1 - August 31 and this would minimize fish impacts especially for downstream migrants. The Corps may extend or shorten the annual maintenance period depending on the scheduled maintenance and environmental conditions. The maintenance period could be shortened if fish collection numbers support continued operations of the FSS after July 1st. Shortening or extending the maintenance period would require coordination with the Willamette Fish Passage Operation and Maintenance team. The amount and type of maintenance would vary from year to year and the Corps would adjust the scheduled maintenance period accordingly. The maintenance period takes advantage of the warmer reservoir temperature, which tends to push fish deeper in the water column; thus, fewer fish would be at the FSS depth for collection. During the maintenance period, the FSS would be debalasted for inspections and maintenance and dive inspections may be required to complete inspections below the waterline. In this position, the FSS draft would be small (approximately 6 ft) and all fish system equipment would be above the reservoir elevation and accessible for maintenance.

The Corps expects hull maintenance to be minimal over time due to the relatively benign water conditions and limited movements of the FSS. The Corps may accomplish maintenance or repair, depending on the location and nature of the hull work, via barges located adjacent to the FSS with the FSS in the maintenance position (minimum draft). If hull bottom or low-elevation maintenance or repair were required, the Corps would disconnect the FSS from the WTCT and floated up-reservoir to the Slide Creek Campground or North Sunnyside location for dry-docking. The Corps would reestablish a flat pad with supports at Slide Creek or North Sunnyside for the dry-docking. The dry-docking operation would be a reverse of the initial launch operation. Impacts to downstream migrants during the maintenance period would be minimal.

2.12.8.4 Continued Operations of the Cougar Adult Fish Collection Facility

Operations and maintenance of the Cougar AFCF would continue with the implementation of this project. Operations and maintenance would continue to follow the 2011 Cougar Adult Fish Facility Operations and Maintenance Manual (Appendix G). The facility personnel would coordinate with the project during construction to ensure they can continue to transport adult fish captured at the AFCF to the designated release sites.

2.12.8.5 Road Maintenance

If the rehabilitated road surface remains gravel, periodic maintenance of supplemental gravel and regrading every five to 10 years to maintain a suitable wearing surface may be required.

2.12.8.6 Debris Management

Debris management in the reservoir would be a key component to successful operation of the FSS. As such, the Corps would implement a comprehensive debris management plan as part of the project construction and operation. The Corps would manage debris from Cougar Reservoir as a part of a multi-stage debris system, described below. At each stage in the system (working from open reservoir to the WTCT wet well), progressively smaller and smaller debris would be filtered out and removed from the water system. Once removed from the reservoir, the Corps would stockpile debris in an open area adjacent to the road on the east side of the dam. USFS has also expressed interest in using large woody debris collected by the project for restoration work downstream of the dam.

1. Debris Boom (Primary)

The primary debris boom’s purpose is to impede large debris (tree trunks, root balls, large logs) from entering the cul-de-sac area of the reservoir. The Corps would string a debris boom with a hanging screen approximately 5-8 ft deep and a dorsal screen approximately 2 ft tall across the reservoir from the upstream side of the Rush Island to the east bank of the reservoir, upstream of the spillway (Figure 27). The Corps would annually remove collected debris, during high pool. The Corps would work the debris through the gate in the boom, move it to the dam upstream access road, and remove it from the reservoir. Removal would likely be by backhoe and truck (Figure 28). This area extends to approximate elevation 1,686 ft, so the Corps would corral debris when the reservoir is above elevation 1,686 ft. This leaves a small window for debris removal and stockpiling at the road area. There was some evidence of rock debris falling onto the asphaltic concrete roadway observed during the site visit. If the Corps were to conduct debris removal at road level, additional rock fall protection may be warranted.

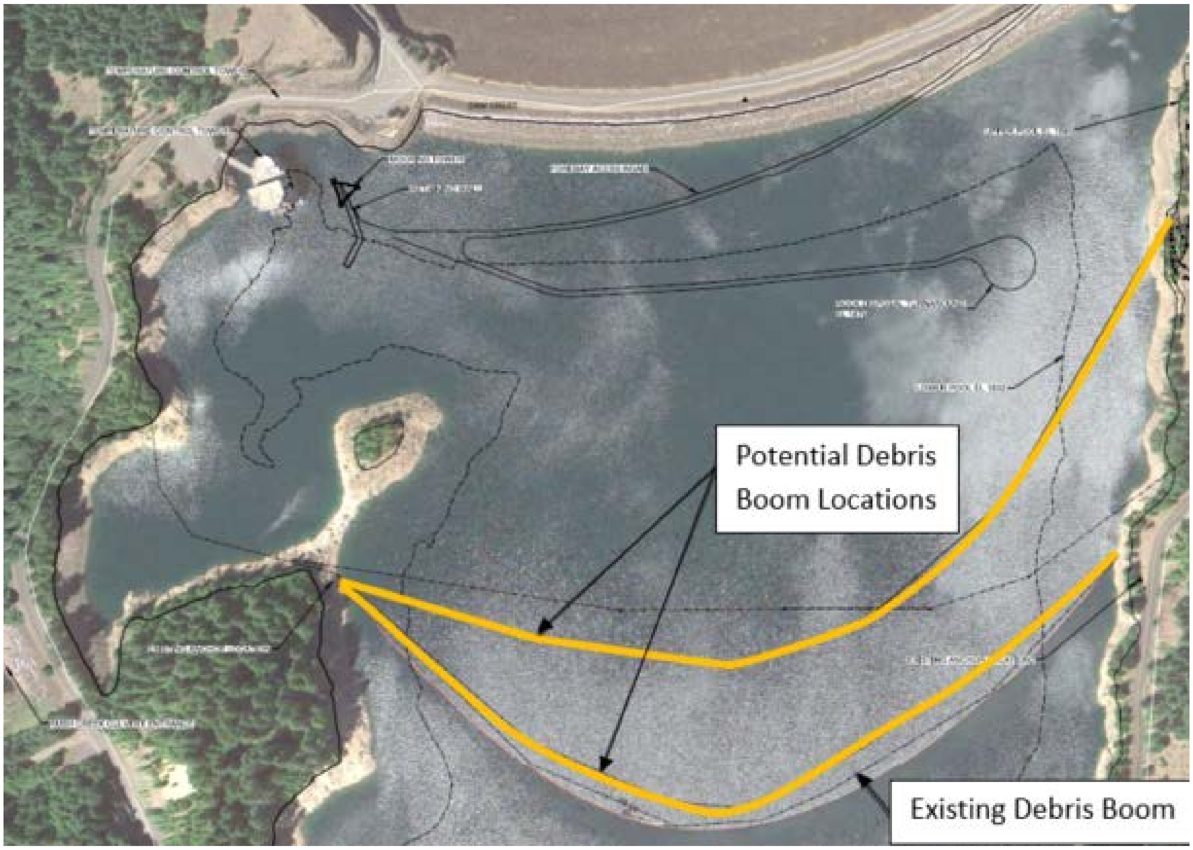

Figure 27. Debris Management System.


Figure 28. Excavator and dump truck Removing Woody Debris from Cougar Reservoir on Cougar Dam access road.

2. Debris Boom (Secondary)

The Corps may use a shorter secondary debris boom if booms are required to trap the debris in a specific area as the debris is moved about the reservoir by wind action. The current is not a major cause of debris movement.

3. Trash Racks, Rake, and Screens (Tertiary)

There would be a course trash rack to stop debris such as large branches and logs from entering the FSS. The Corps would remove this debris with a trash rake automatically or manually. The trash rake would remove the debris from the racks and transport it along the overhead rail system to the dump barge located in a slip on the FSS. The Corps would remove by hand any debris that makes it into the FSS and deposit it into the debris hopper for transport on the debris barge. The Corps would then tow the debris barge to the dumpsite described above.

2.12.8.7 Power

The Corps would modify the existing utility connection at the WTCT to power the new shore side switchboard for the FSS. A set of two shore power cables would provide power transmission between the WTCT and FSS. An emergency generator would be located on the WTCT and sized to provide sufficient backup power to maintain personnel safety on and around the FSS and prevent damage to the FSS, surrounding infrastructure, and captured fish.

2.12.9 Monitoring and Evaluation

Currently, the Corps funds USGS to monitor/measure continuous TDG, temperature, and flow data downstream of Cougar Dam[3]. The Corps also measures temperature at various depths in the reservoir continuously. All data is telemetered to a real-time network and available instantly on the web[4]. This monitoring would continue before, during, and following project construction.

Additional monitoring during construction and operations of the FSS would change during each phase of the project. Fish removal activities within the cul-de-sac would be required during the reservoir drawdown for construction. Therefore, during the reservoir drawdown, the Corps would monitor the cul-de-sac area for fish stranding. At the time of this EA, the fish monitoring and salvage plan is under development. However, this plan would be similar to the 2016 Fish Salvage Plan for debris removal and WTCT trash rack repairs at Cougar Dam (Appendix E).

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[3] https://waterdata.usgs.gov/nwis
http://www.nwd-wc.usace.army.mil/dd/common/dataquery/www/

[4] http://www.nwd-wc.usace.army.mil/nwp/wm/wq_reports.html
https://or.water.usgs.gov/cgi-bin/grapher/graph_setup.pl

At the time of this EA, what monitoring the Corps would perform during operation of the FSS and how often is under development. However, the Corps would monitor fish health on the FSS periodically. This monitoring would occur intensively in the initial years of operations and through routine periodic monitoring thereafter, including sub-sampling the fish collected in order to estimate descaling rates. Additionally, the Corps would monitor species composition (non-salmonids in the sub-sample) daily. The Corps would also monitor overall water quality on a daily basis on the FSS and at the tailrace release location.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONCEQUENCES

The sections below describe the existing conditions of resources potentially affected by implementation of the project alternatives described in Section 2. The resource descriptions provided serve as the environmental baseline with which to compare the potential effects of the project alternatives considered in this EA. The Corps has evaluated two alternatives in detail: the No Action Alternative (Alternative 1) and the proposed action (Alternative 2).

This EA only evaluates those resources that the alternatives may affect including physical, biological, and social resources. Other resources, including land use, agricultural resources, mineral resources, public services (i.e., sewer waste, water lines, etc.), public safety, and hazardous materials were considered but not carried forward for detailed analysis because the resources would not be impacted through proposed action implementation. The project will only affect federally owned property: no farmland, mineral resources, or hazardous material sites are affected by the proposed action. The Corps has evaluated the following resources for potential effects:

- Air Quality
- Noise
- Geology, Seismology, and Soils
- Hydrology and Hydraulics
- Water Quality
- Climate Change
- Vegetation
- Wildlife
- Fish and Aquatic Species
- Threatened and Endangered Species
- Water Supply
- Hydropower
- Transportation/Circulation
- Aesthetic Resources
- Cultural, Archeological, and Historic Resources
- Recreation
- Socio-Economic

This EA discusses the range of potential environmental consequences the alternatives would have on each of the above listed resources in the project area. The EA describes the intensity of these consequences in the context of two effects categories: (1) direct effects, which occur at the same time and in the same place as the action; and (2) indirect effects, which occur later or

at a location away from the action. The EA describes the intensity of effects as negligible, minor, moderate, and major, with a major impact indicating a significant impact. Existing or baseline conditions are used to evaluate and predict the potential effects, both short and long term, resulting from implementing the No Action Alternative or the proposed action. The analysis period for direct and indirect effects begins with construction activities and extends for a duration of 50 years (2073) following implementation, the Corps' prescribed planning horizon. The EA discusses cumulative effects as additive and include those effects which occur in the past, present, and reasonably foreseeable future. Cumulative effects are in Section 3.27.

The Corps' construction of the Cougar Dam initiated fundamental changes to the South Fork McKenzie watershed and the McKenzie River sub basin including the elimination of fish passage between the lower rivers and upstream spawning habitats. In addition, construction of the dam altered stream flows that affect downstream water quality and the quantity and quality of in stream and riparian habitats. The resource descriptions provided below serve as the baseline condition (current condition, not pre-dam condition) against which the potential effects of the project alternatives are evaluated in the following sections. For each of the resource categories listed above, the EA evaluates the environmental consequences of the No Action Alternative under the assumption that no changes to existing dam operations continue in the future. Environmental consequences under the Alternative 2 describe the project site state assuming the Corps implements the downstream passage actions described in Section 2.12.

3.10 Air Quality

The Environmental Protection Agency (EPA) has established human health-based National Ambient Air Quality Standards (NAAQS) for six air pollutants (criteria pollutants): particulate matter (PM10 and $PM_{2.5}$: particulate matter less than or equal to 10 or 2.5 microns), ozone (O^3), carbon monoxide (CO), sulfur dioxide (SO^2), nitrogen dioxide (NO^2), and lead (Pb). For each of the six criteria pollutants, EPA defines NAAQS and SAAQS as a maximum concentration above which adverse effects on human health may occur. EPA defines geographic areas in which the ambient concentrations of a criteria pollutant exceed the NAAQS as non-attainment areas. Federal regulations require states to prepare statewide air quality planning documents called State Implementation Plans that establish methods to bring non-attainment areas into compliance with the NAAQS and to maintain compliance. EPA calls non-attainment areas that return to compliance "maintenance areas". No part of the project area is a designated as a non-attainment or maintenance area for criteria pollutants (ODEQ 2013).

The Lane Regional Air Protection Agency (LRAPA) manages air quality in the study area. LRAPA continuously monitors three of six pollutants in Lane County: particulate matter, ozone, and carbon monoxide. Air quality in most of Lane County is very good, with Eugene/Springfield

averaging 323 days a year in the “green” (good) category of the air quality index. However, some inland areas and mountain valleys experience periods of air stagnation. During winter months, this often traps cold air near the valley floor, with slightly warmer air aloft, and creates temperature inversion conditions. The combination of cold stagnant air and restricted ventilation traps air pollutants near the ground. Wintertime temperature inversions contribute to high particulate levels. Stagnant periods in the summertime contribute to increases in ozone levels, causing the local air quality to deteriorate.

Historically, LRAPA had designated the Eugene-Springfield Urban Growth Area as a non-attainment area for PM10. Currently, Eugene meets both the PM10 and PM2.5 standards and is in the process of regaining attainment status. Lane County, in its entirety, is in attainment with the federal ozone standards. The Eugene/Springfield area was designated a “non-attainment” area for CO in the late 1970s, but was later redesignated as an attainment area in 1994 (LARPA 2009).

3.10.1 Environmental Consequences

3.10.1.1 Alternative 1. No Action

The No Action Alternative would not alter the existing air quality. Consequently, there would be no changes to existing conditions under the No Action Alternative.

3.10.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Under the proposed action, a small, localized reduction in air quality would occur due to emissions from construction equipment. These impacts would be minor and temporary in nature, and would cease once construction is completed.

Reduced generation of hydroelectric power because of drawdown of Cougar Reservoir and reduction in river flow might indirectly cause additional air emissions from thermal power plants.[5] These facilities, however, would not impair air quality in the region because they are subject to New Source Performance Standards and permitting requirements that restrict air emissions from such facilities to ensure that air quality is not degraded.

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[5] According to the Northwest Power and Conservation Council’s 7th Power Plan, the most likely thermal generating plant would be a Combined-Cycle Generating Station for On-Peak generation, which is produced at Detroit, Lookout Point, and Green Peter. The remaining Willamette Valley plants operate as Base Load (run-of-river) where the emissions come from a different mix of thermal generating plant types which are powered by a mix of fuels.

3.11 NOISE

Noise in the action area does not typically exceed the Lane County noise ordinances (Code 6.5) which prohibit noise that exceeds 50 A-weighted decibels (dBA) at any time between 10:00 p.m. and 7:00 a.m. the following day, or 60 dBA at any time between 7:00 a.m. and 10:00 p.m. on the same day. Additionally, the Lane County ordinances prohibit noise that is plainly audible at any time between 10:00 p.m. and 7:00 a.m. on the following day within a noise sensitive unit that is not the source of the sound, or on a public right-of-way at a distance of 50 ft or more from the source of the sound. Generally, the ordinance allows the use of construction equipment at normal operating levels between the hours of 7 a.m. and 7 p.m.

3.11.1 Environmental Consequences

3.11.1.1 Alternative 1. No Action

Under the No Action Alternative, noise levels would remain consistent with existing conditions because there would be no construction noise. Consequently, there would be no changes to existing conditions under the No Action Alternative.

3.11.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Under the proposed action, there would be localized increases in noise levels from construction equipment. These impacts would be minor, temporary in nature, and would cease once construction is completed.

3.12 GEOLOGY, SEISMOLOGY, AND SOILS

Cougar Dam is located at the transition zone between the Western Cascades and High Cascades in Oregon. The site lies along the faulted boundary between the young volcanic province of the High Cascades and the deeply eroded, uplifted Western Cascades. The 1957 Geology and Foundation memorandum (DM 10), the 1964 Foundation Report, and the 1997 Foundation Investigation report for the diversion tunnel extensively describe the site geology of the Cougar Dam area (USACE 1957, 1964a, 1967; Squire, 1997). The 1988 Geologic Map of the McKenzie Bridge Quadrangle (Priest et al., 1998) provides additional information. The 1997 Cougar Reservoir Willamette Temperature Control Intake Structure memorandum, DM 21, describes conditions in the immediate vicinity of the intake (USACE 1997).

The two primary rock units within the foundation of Cougar Dam are a series of bedded tuffs, referred to as the Cougar Dam Tuffs, and a younger unit of intrusive dacite, referred to as Cougar Dam Dacite. Boring logs and geologic maps from original dam construction refer to this dacite unit as basalt. The massive Cougar Dam Dacite intrusion forms the dam’s right and left

abutments, as shown in Figure 29. Across the valley floor, the dacite thins to an approximate 40 ft layer that runs roughly parallel to the dam axis and connects the two abutment masses.

Site Seismicity

The study area is located in Zone 3, with moderate probability for earthquakes. Amec Foster Wheeler produced a regional seismic study for the Willamette Valley for USACE Risk Management Center in accordance with EM 1110-2-1806. The final version of this report, incorporated here by reference, was provided to USACE in June of 2017 and includes a detailed description of the tectonic setting (Amec et al., 2017).

Existing WTCT Site Geology and Soils

Construction records indicate that little to no overburden covered the bedrock near the WTCT. Bedrock the Corps removed during construction was scattered in limited patches one to two ft thick, consisting of weathered rock fragments in a silty matrix. The Corps expects the proposed construction area to consist entirely of rock and rock fragments; any overburden remaining in the area would be localized shallow accumulations rock fragments and soil and embankment rockfill shell. Existing conditions at the WTCT are based on three historic borings drilled to elevations 1,411 ft to 1,460 ft during the original construction of the intake. The Corps performed these borings to investigate a major fault zone that crossed the northeastern portion of the excavation. A fourth boring drilled nearby at the diversion tunnel indicates that the Dacite overlies the bedded layers of mudstone and lapilli tuff that make up the Cougar Tuffs. The Corps had eight additional exploratory borings drilled in 1997 from inside the diversion tunnel (Squier 1997). The results of their explorations confirm the stratigraphy described in prior borings.

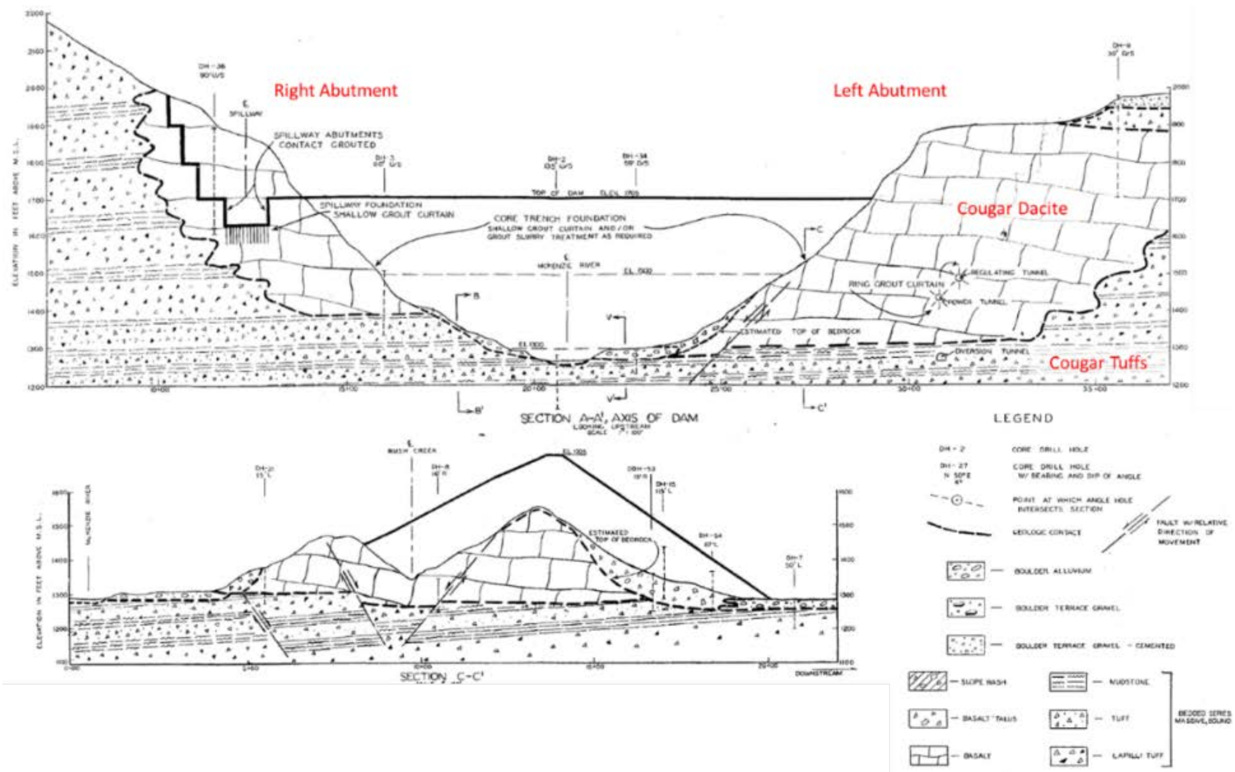


Figure 29. Geologic Map Showing Approximate Extents of Dacite and Tuffs, as Taken From 1964 Foundation Report.

The foundation for the WTCT consists entirely of massive, gray Cougar Dam Dacite. The dacite is unweathered, fine-grained, and hard with relatively little oxidation and mineralization. This rock knob (Figure 15) serves as the foundation of the embankment left abutment of the dam. Based on geologic maps from the original construction, the contact of the Cougar Dam Dacite with the underlying Cougar Tuffs is roughly between elevations 1,300 ft and 1,350 ft. A series of near-parallel faults make up a fault zone approximately 80 ft wide, which trends across the northeast part of the penstock intake foundation. The fault zone parallels an intruded basalt dike. Individual faults generally strike between N40W and N50W and dip steeply in both directions. Gouge and brecciated zones are associated with the individual faults, with gouge zones up to 12 in wide. The fault zone is present within the northeastern corner of the penstock structure foundation and caused stability problems for the northeastern cuts during the original intake excavation, including the trash rack bridge pier foundation, but reportedly did not affect the bearing capacity of the rock. Figure 30a shows the original intake excavation with an overlain outline of the approximate limits of the structure; Figure 30b shows the approximate extent of the fault zone uncovered during excavation.

a. b.

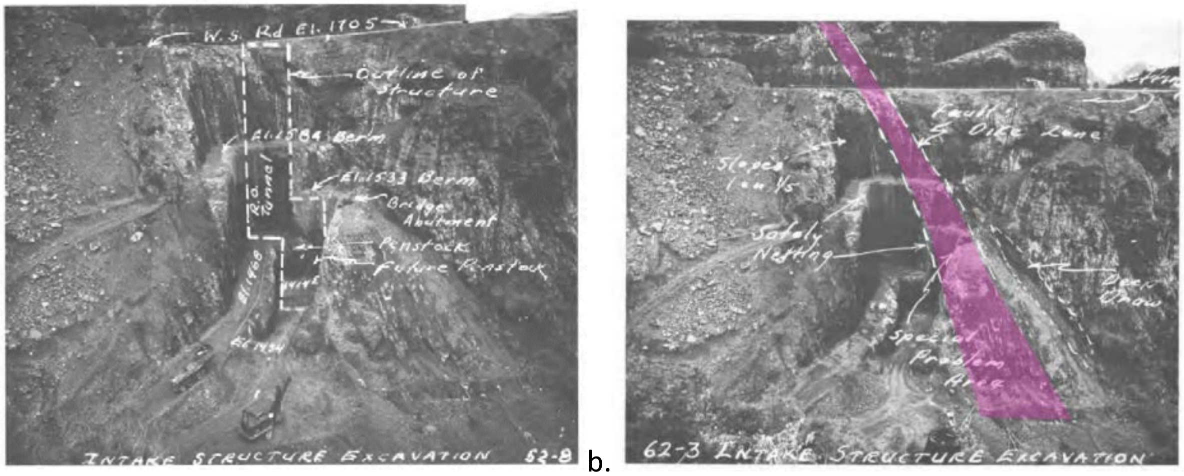


Figure 30. a. Original Intake Excavation: Dashed Outline Shows Location of the Intake Structure. b. Intake Structure Excavation (top) and Field Sketches (bottom) with Location of Basalt Dike in Pink.

<u>Slide Creek and North Sunnyside Site Geology and Soils</u>

The Corps did not conduct explorations near Slide Creek Campground or North Sunnyside during the dam's original construction. Geologic mapping of the area characterizes the deposits as Quaternary surficial deposits composed of a mix of unconsolidated alluvial and colluvial sediments. The Corps expects much of the material is ancient landslide deposit overlying ancient alluvial deposits comprising a mix of silt, sand, gravel, and cobbles.

3.12.1 Environmental Consequences

3.12.1.1 Alternative 1. No Action

The No Action Alternative would not change the current geology, the geologic processes would remain the same, and the project area would experience no direct or indirect effects on geology seismology, and soils.

3.12.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

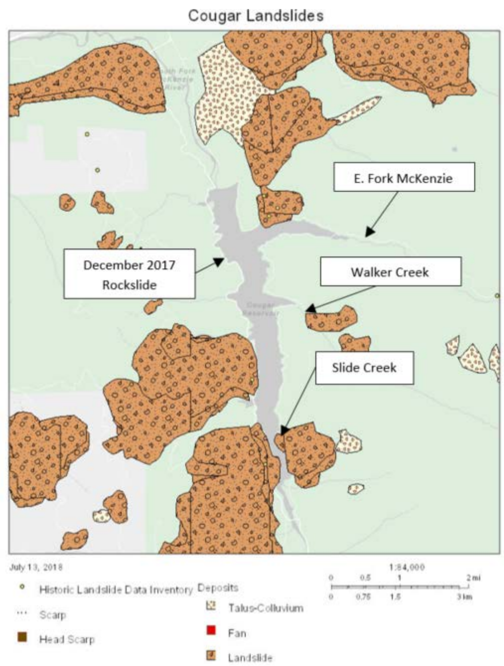
Under Alternative 2, the Corps expects no impacts to seismology. Neither construction nor operation would affect the earthquake probability, nor would drawdown for construction result in additional impacts should an earthquake occur. The drawdown would reduce the likelihood of downstream flood damage should a structurally damaging earthquake occur during construction.

Under Alternative 2, the Corps expects primarily minor, short-term impacts to geology and soils localized to areas where active construction is occurring around the WTCT and the

potential FSS staging sites (Slide Creek Campground or North Sunnyside). There would be minor impacts to rock slopes at the WTCT as the drawdown of the reservoir would remove stabilizing hydrostatic forces, potentially inducing instability of the steep rock slopes. Rockfall hazard from unwatering is a higher hazard in jointed and fractured rock. Figure 31 shows a rockfall of approximately 8000 cubic yards that occurred during the winter of 2017. Rock and rockfill excavation around the intake could also produce localized instability, particularly within the vicinity of the dike and fault zone. The effects of construction activities on rock stability are short-term (during construction only) and the Corps would mitigate these effects with the installation of both temporary and permanent rock reinforcement. As such, the Corps does not expect construction to produce long-term instability effects in the area. Construction activities at the chosen FSS staging site (either Slide Creek Campground or North Sunnyside sites) would require grading, small cuts, and placement of fill. Though the area is within an ancient landslide deposit, the Corps expects potential slope instability induced by soil cuts to be localized and small scale. Cuts into native soil could induce small localized slope instability if cut too steeply. The Corps expects this hazard to be short term and would moderate any hazard by minimizing allowable height and angle of cut slopes.

Under Alternative 2, the Corps expects that potentially moderate impacts may occur in areas around the reservoirs edge that have the potential for landslide reactivation due to drawdown. These impacts include landslides or rock falls resulting from the drawdown that require road repair. Several mapped landslide deposits flank Cougar Reservoir’s steep slopes. Figure 31 shows known landslide deposits generated using the Oregon Department of Geology and Minerals web GIS-based landslide mapping tool. Slides on the east bank near the East Fork McKenzie appear to extend to below minimum pool and have the potential to cause movements which extend to above the East Bank Road, which therefore may cause damage to existing roadways. Damage would probably be limited to horizontal and vertical movements of a few inches to several feet. Landslides within the reservoir area normally move in a relatively slow progressive manner with the initial movement occurring near the toe and progressing upslope over a period of time. Due to the distance from the toe area to the East Bank Road and the slow rate of progression of these slides, the period of time required for movement to occur in the roadways may be a year or more after the initial movement occurs, and may continue for a few years after construction is completed. However, there was no documented movement on these slides during the 2002 or 2016 deep drawdowns. Reservoir drawdown rate for the construction drawdown would be limited to 3ft/day, which would reduce the risk of landslide reactivation. Additionally, deep drawdown would occur over the summer months, which limits the added seasonal risk from winter heavy rainfall. The Corps considers impacts only moderate because the Corps anticipates being able to easily repair any damage to the road if a landslide were to occur. The Corps anticipated this because it is a little-used, gravel, 4-wheel-drive road.

Main access to Slide Creek Campground from Aufderheide Road (West reservoir rim road) would not be impacted.



a.

b.

Figure 31: a. Landslide deposits around Cougar Reservoir (DOGAMI, 2018). b. Rockslide along left bank reservoir road in December 2017.

3.13 Hydrology and Hydraulics

Cougar Dam is located in the McKenzie River system, an area of approximately 12,000 square miles within the Willamette River Basin (Figure 32). The McKenzie River drains a sub-basin along the west flank of the Cascade mountain range. The majority of runoff occurs during the winter, with peak flows in the upper watershed resulting from winter runoff and spring snowmelt. Flows are naturally lowest in the late summer and early fall. Since its completion in 1963, Cougar Dam has regulated river flows. The reservoir attenuates inflows during flood events and augments downstream river flows during periods of low inflow.

The Corps operates Cougar Dam - together with the system of 12 other dams in the WVS - to meet basin-wide objectives including minimum flows to support biological functions. Changes to normal operations at Cougar Dam affects how the Corps operates other dams in order to meet basin-wide objectives. The Corps has established minimum reservoir releases at each of the Corps' WVS projects to help maintain in-stream flows the interest of protecting fish habitat and to accommodate existing rights of access to natural streamflows. Storage releases from the Corps' reservoirs also augment channel depths for navigation and have helped to reduce levels of pollution that formerly prevailed in the basin streams. Over time, water quality has become

an important state and federal objective. The Corps maintains flows of 5,000 cfs and 6,500 cfs at Albany and Salem, respectively, to help ensure water quality in the river. Additionally, the 2008 BiOps required the Corps to meet or exceed minimum tributary flow objectives to ensure adult fish access to existing spawning habitat below Corps dams, protect eggs deposited during spawning, and provide juvenile rearing and adult holding habitat for listed salmonids and other fishes within system constraints.

Figure 32. The Willamette River Basin.

Cougar Dam works in tandem with Blue River Dam, in the McKenzie sub-basin, to provide flood damage reduction benefits to downstream points with a downstream control point located at the Vida USGS gage No. 14162500 (Figure 1). Prior to dam construction, the highest flow recorded on the McKenzie River at Vida was 64,400 cfs in December 1945 when flows

greater than 40,000 cfs were common (Hubbard et al. 1996). Since construction of the Corps dams, the two-year recurrence interval event at Vida has decreased from approximately 29,200 cfs to about 17,500 cfs; no flows greater than about 35,000 cfs have occurred. The average daily flow in September prior to construction of the Cougar Dam was 2,030 cfs. Since its construction, the average daily flow in September has increased to 2,956 cfs (Moffatt et al., 1990). Post-dam summer flows are greater than historically occurrences, because storage is available at Corps facilities to redistribute flood volumes and release water later in the year for flow augmentation purposes.

The Corps operates Cougar Dam to meet the State of Oregon's request for mainstem flows (which match the BiOp mainstem flows). Cougar Dam is also required to meet project minimum outflows as defined in the project's WCM (USACE 1964b) and to meet, or exceed, the minimum tributary flows as specified in the 2008 BiOp by providing the recommended flows. BiOp recommendation is 300 cfs year-round except 400 cfs in June. The Corps operates Cougar Dam to meet the BiOp recommended hourly ramp down rates of 0.1 feet per hour during daylight hours and 0.2 feet per hour during nighttime hours. During high flow periods and flood damage reduction operations, pre-BiOp baseline ramp down rates limited to 500 cfs per hour (Corps 2000). The normal rate of increase at Cougar Dam is 500 cfs per hour when initial flows are greater than 500 cfs (if below 500 cfs, ramp up rate is 250 cfs/hour). Maximum rate of increase is 750 cfs/hour. In addition to Cougar and Blue River dams, Eugene Water and Electric Board's (EWEB) Carmen-Trail Bridge complex also attenuates peak flows. The combined operations of these projects has substantially decreased the magnitude and frequency of extreme high flow events in the lower river, although the influence of the Carmen-Trail Bridge complex is small relative to the Corps projects because they are small and operated essentially as run-of-the river projects.

The largest diversions from the McKenzie River are associated with hydropower developments. However, multiple smaller diversions/canals are located along the McKenzie River, including Leaburg Dam (river mile 29) and the Carmen-Smith Hydroelectric Project (river mile 82), both owned by the EWEB (Figure 1). Almost all of the water diverted for hydropower use and roughly half the water diverted for other uses returns downstream to the river from point of diversion. These withdrawals and returns decrease and increase the flow in the McKenzie by approximatley 50%. Flows in the river reaches between the point of diversion (e.g., the Leaburg and Walterville canals) and the point of return (e.g., Leaburg and Walterville powerhouse tailraces) are at times substantially reduced (NMFS, 2008). At RM 35 Leaburg Dam diverts up to 2,500 cfs into the Leaburg canal, which reduces flows in approximately 5.8 miles of the McKenzie River. EWEB may reduce flows to 1,000 cfs in the reach between the diversion and the powerhouse tailrace in accordance with the project's hydropower license (FERC 1996). At about RM 25, EWEB diverts up to 2,577 cfs into the Walterville canal, which reduces flows in

approximately 7.3 miles of the McKenzie River. EWEB may also reduce flows to 1,000 cfs in the intervening river reach. Flows approaching these minimum are most likely to occur during July, August, September, and October.

3.13.1 Environmental Consequences

In order to understand system impacts, the Corps used the HEC-ResSim computer model to simulate daily reservoir operations in the Willamette Basin under various hydrologic conditions. The No Action Alternative simulation represents current operational conditions for a 73-year period of record (1935-2008). In this simulation, all reservoirs follow regulation rules consistent with current project and system objectives and practices. The Alternative 2 simulation represents operational conditions during construction of the FSS where Cougar reservoir attempts to maintain a pool elevation of 1,450 ft while continuing to meet release requirements and targets, as possible. All other WVS reservoirs maintain rules from the No Action Alternative.

3.13.1.1 Alternative 1. No Action

Under the No Action Alternative, the hydrology would reflect existing conditions. Dam operators would continue to maintain outflows and reservoir levels in accord with requirements described in the WCM (USACE, 1964b) and in other process and procedures documents.

3.13.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Alternative 2 would have minor, short term impacts to hydrology associated with the drawdown. During construction and a drawdown to elevation 1,450 ft, Cougar Dam would release higher outflows in the summer and lower outflows in the fall compared to existing conditions (Figure 33). This will limit the Cougar Reservoir’s ability through the storage and release of water to assist in meeting the Willamette Valley system goals. Therefore, several other WVS reservoirs operate in response to Cougar’s operational limitations as needed to meet system objectives; however, these reservoirs will still be able to adhere to their project specific rules and constraints.

When simulating a maintained pool elevation of 1,450 ft at Cougar Reservoir, model results show that Cougar’s average outflow is less than its average outflow in the No Action Alternative during the summer and fall (July - November) while outflows in spring (February - May) exceed those from the No Action Alternative (Figure 33). However, these outflows would be close to reservoir inflows. The Corps does not expect outflows to affect downstream resources. Under existing conditions and in the No Action Alternative, the Corps reduces outflow from Cougar Dam during the spring in order to store water and refill to its summer conservation pool

elevation. Additionally, under existing conditions and in the No Action Alternative, the Corps increases outflow in fall in order to draft the reservoir to its winter conservation pool elevation. The Corps would not conduct these storage and drafting operations under Alternative 2.

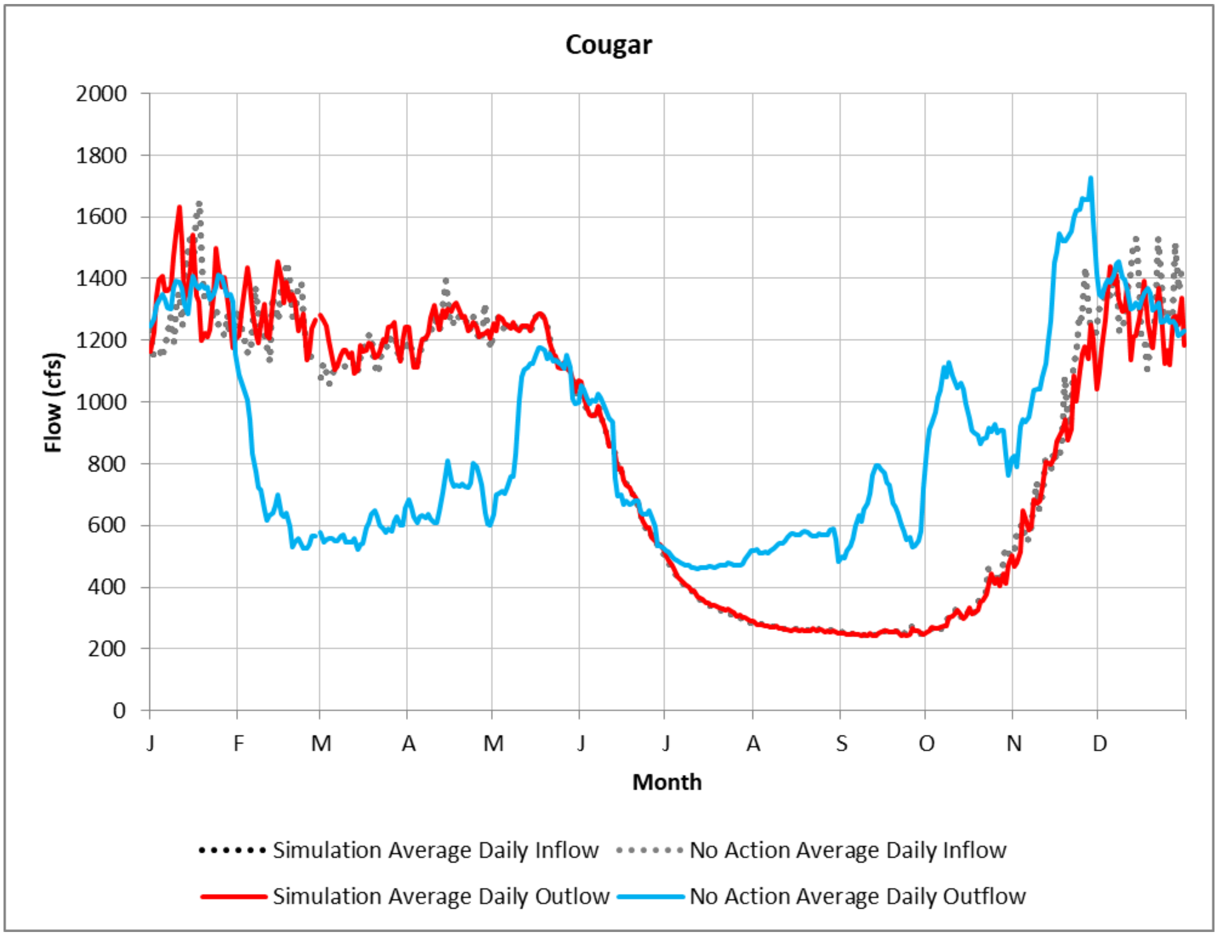


Figure 33. Simulated Average Daily Outflow at Cougar Reservoir (1935-2008).

In response to the reduced outflow from Cougar Dam, the Corps would increase outflow from Blue River, Dorena, Fall Creek, Hills Creek, and Lookout Point from July - October in order to meet downstream minimum flow targets at Albany and Salem. During this period, average reservoir elevations are slightly lower at these projects. Figure 34 compares the average daily elevation between alternatives for nine projects with variable elevations. The Corps sees the largest elevation differences at Fall Creek and Hills Creek with average changes of 4.9 ft and 4.1 ft at the beginning of September, respectively. The outflow contributions from these reservoirs enable the system to reach minimum flow targets with success similar to the No Action Alternative. For example, at Salem, the annual average number of days when WVS missed BiOp flow targets was 33 days in Alternative 2 versus an average of 32 days in the No Action Alternative. Figure 35 compares the regulated average daily outflows at Salem between alternatives throughout the year under Alternative 2.

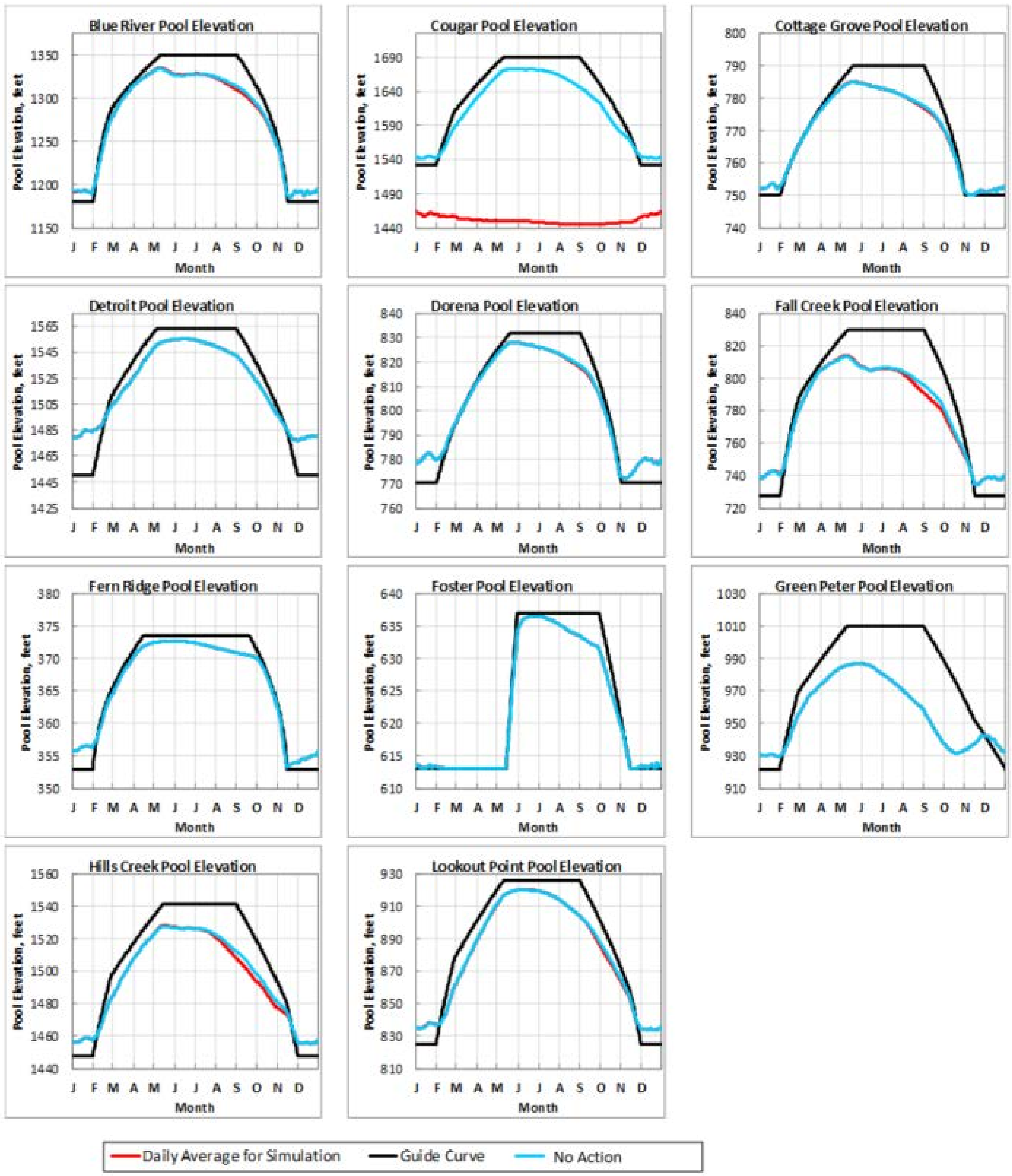


Figure 34. Alternative 2 Simulated Daily Average Elevations at WVS dams (1935-2008)

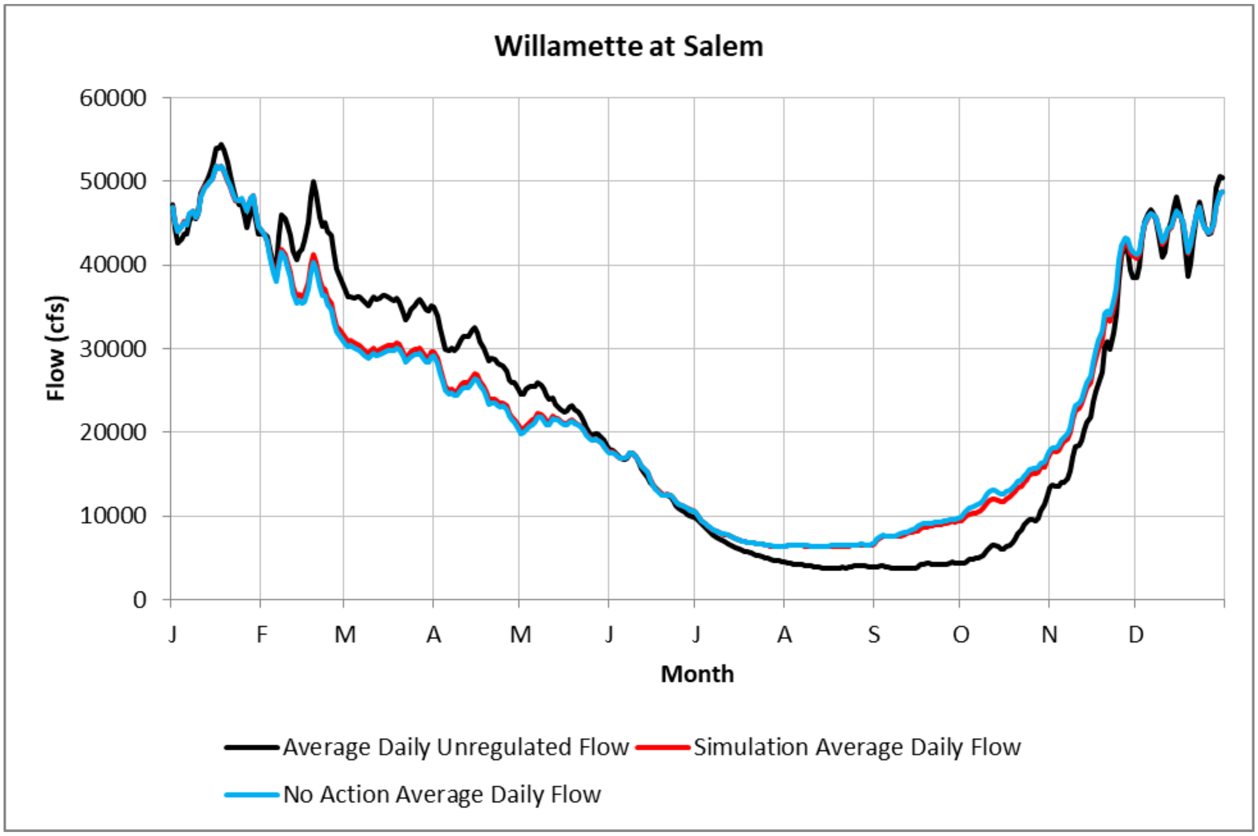


Figure 35. Simulated Daily Average Flow at Salem (1935-2008).

3.14 Water Quality

Owing to the dominance of spring discharges in the river's headwaters with groundwater residence times of five to 10 years (Grant et al. 2004), the McKenzie has excellent natural water quality with low concentrations of nutrients (nitrogen and phosphorus), very low sediment loads and turbidity, high concentrations of dissolved oxygen, and a neutral pH. Cougar Reservoir is considered an oligotrophic lake, due to relatively low nutrient levels (Hains, 1997), low primary productivity of phytoplankton, and high water clarity (Larson, 2000). Human activity has added small amounts of waste contaminants (e.g., fecal coliforms) to the river, and dam operations have altered the downstream McKenzie River thermal regime and TDG concentrations.

ODEQ maintains ambient water quality monitoring sites throughout Oregon and measures trends in water quality using the Oregon Water Quality Index[6]. The Index analyzes a defined set of water quality parameters including temperature, dissolved oxygen, biochemical oxygen demand, pH, total solids, ammonia and nitrate nitrogen, total phosphorous, and fecal coliform. The Index produces a score describing general water quality. ODEQ groups the scores into the

[6] https://www.oregon.gov/deq/wq/Pages/WQI.aspx

following categories: less than 60 (very poor), 60-79 (poor), 80-84 (fair), 85-89 (good), and 90-100 (excellent).

In 2006, ODEQ developed the Willamette Basin Total Maximum Daily Load (TMDL) for which ODEQ evaluates tributary rivers and streams in the Willamette River watershed. A TMDL is a tool for implementing water quality criteria and is based on the relationship between pollution sources and in-stream water quality conditions. The McKenzie Subbasin (Hydrologic Unit Code 17090004) has stream segments listed under section 303(d)(1) of the federal Clean Water Act (CWA) that exceed water quality criteria for temperature and dissolved oxygen. The temperature TMDL for the McKenzie Sub-basin includes tributaries to the McKenzie River downstream of the confluence of the South Fork McKenzie River, Blue River upstream of Blue River Reservoir, and South Fork McKenzie River upstream of Cougar Reservoir within HUC 17090004 (Figure 36).

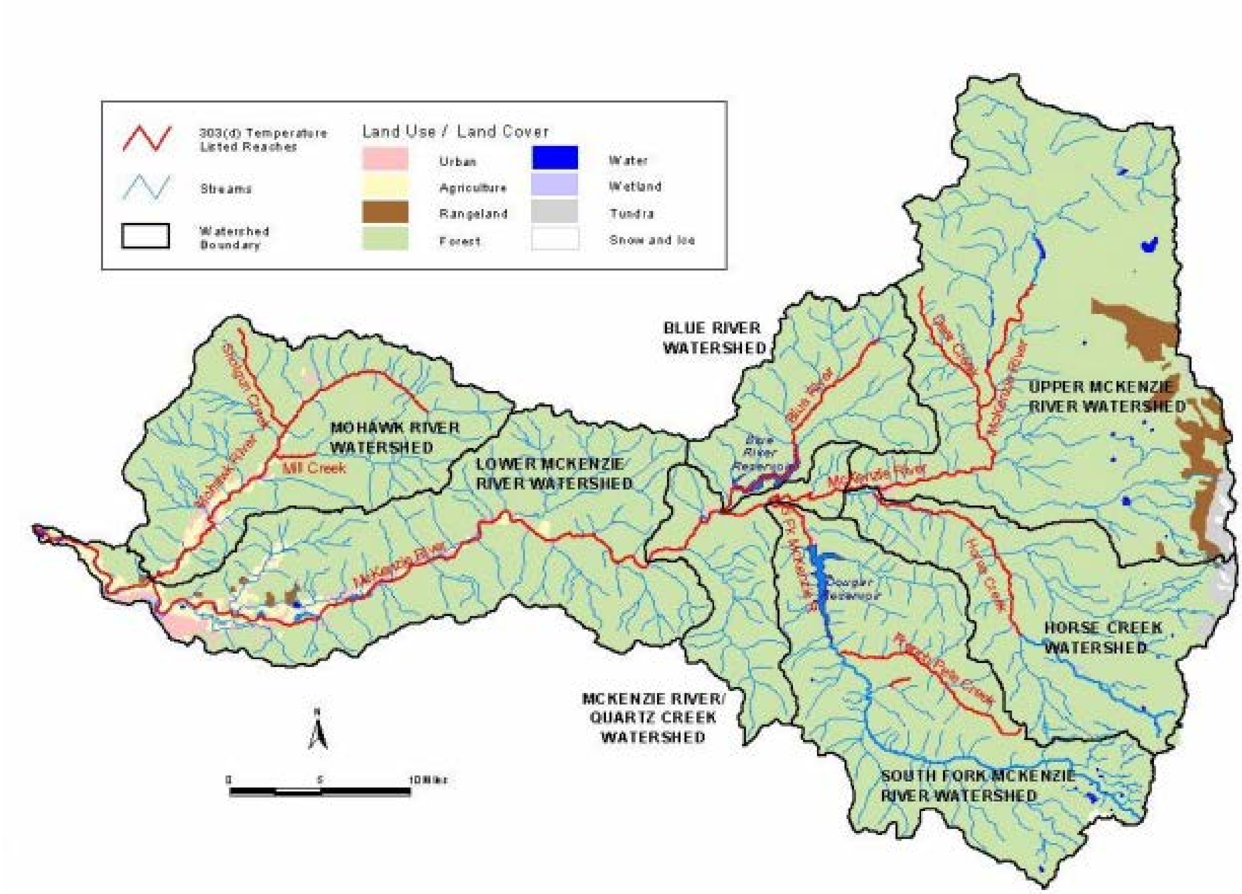


Figure 36. 303(d) Listed Streams for Temperature in the McKenzie Subbasin.

3.14.1 Temperature

Cougar Reservoir typically thermally stratifies by April each year as it fills in the spring. Scenarios were used to simulate water temperature over a range of hydrologic and meteorological conditions in Cougar Reservoir using the CE-QUAL-W2 model (Cole and Wells, 2015; USACE, 2018). Figure 37 - Figure 40 show lake elevation and in-lake water temperature (color) for each calendar-year simulation of simulated operations (2001, 2004, 2006, and 2008). Year 2001 represents a hot-dry year, while 2004 and 2006 are relatively normal, with 2008 relatively cool with wet conditions. Releases during the summer from the reservoir's surface, when the lake is above 1,561 ft, reduce the amount of warm water in the epilimnion (e.g., the upper layer of water in a stratified lake). When the lake is below 1,561 ft, releases come from the deeper RO invert elevation (1,479 ft). Construction of the WTCT at Cougar Reservoir was finished in 2005 and enabled selective release of lake surface flows from Cougar Dam at elevations 1,690 ft to 1,561 ft. Current operations result in release temperatures immediately downstream of Cougar ranging from about 63°F in July - August to approximately 40°F during December - March (Figure 41).

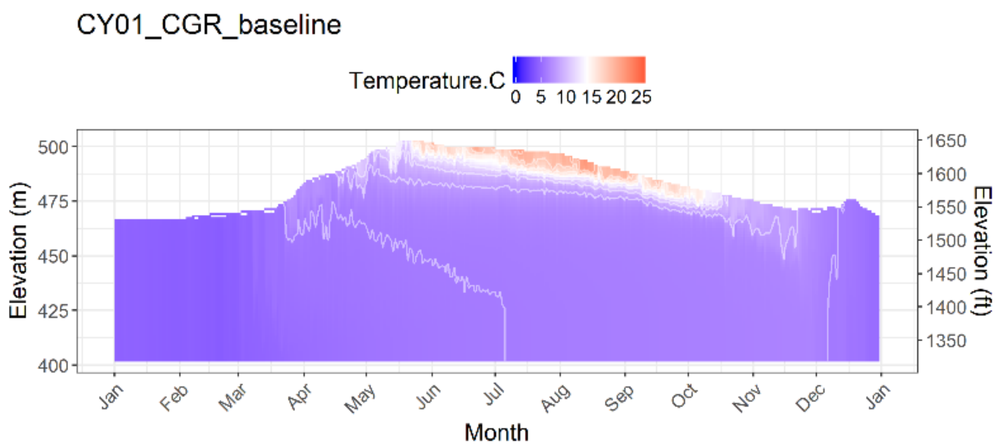


Figure 37. Lake elevation and water temperature (color) through 2001 under existing operations.

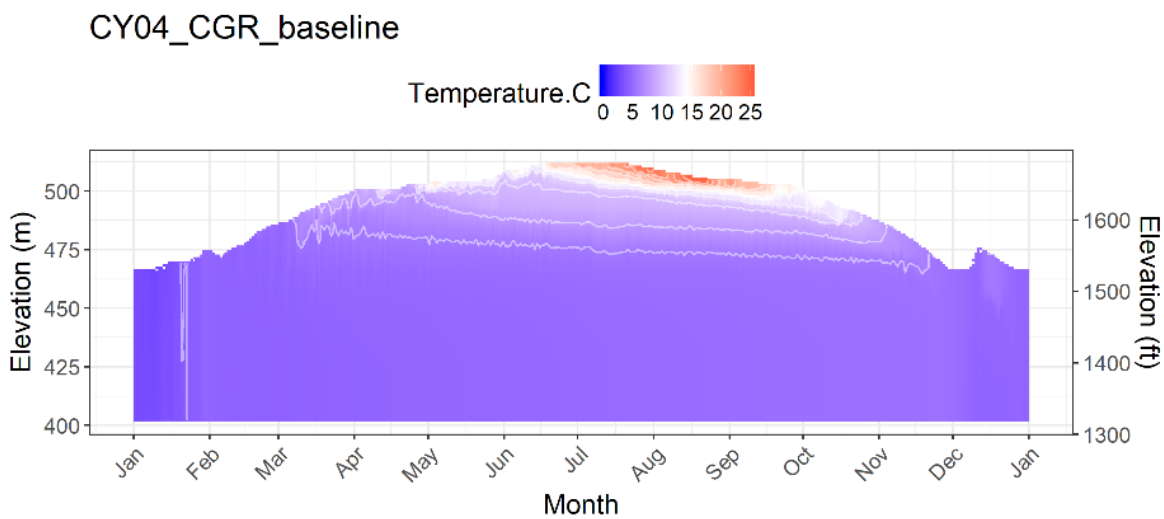


Figure 38. Lake elevation and water temperature (color) through 2004 under existing operations.

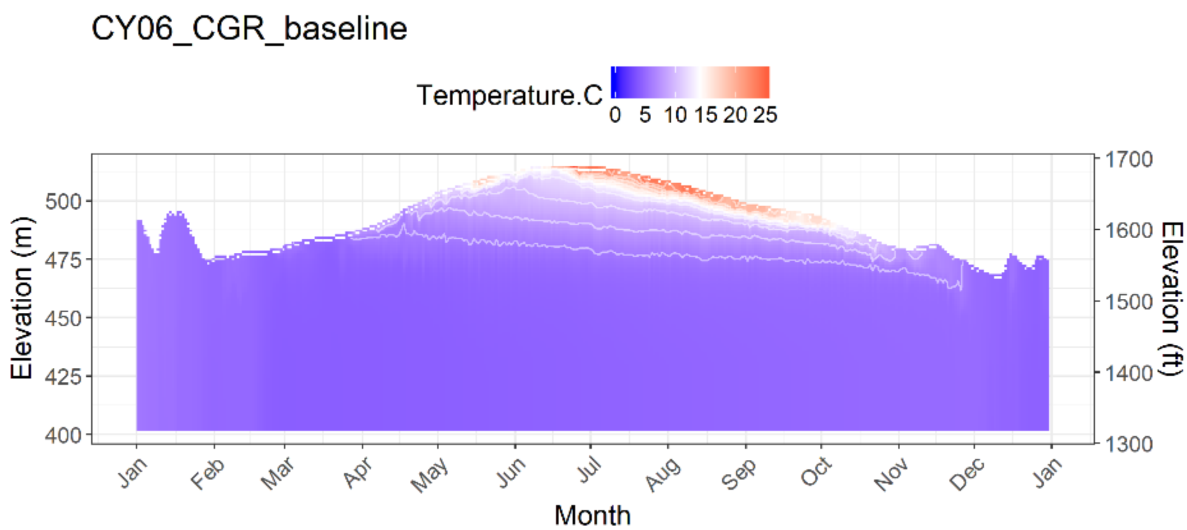


Figure 39. Lake elevation and water temperature (color) through 2006 under existing operations.

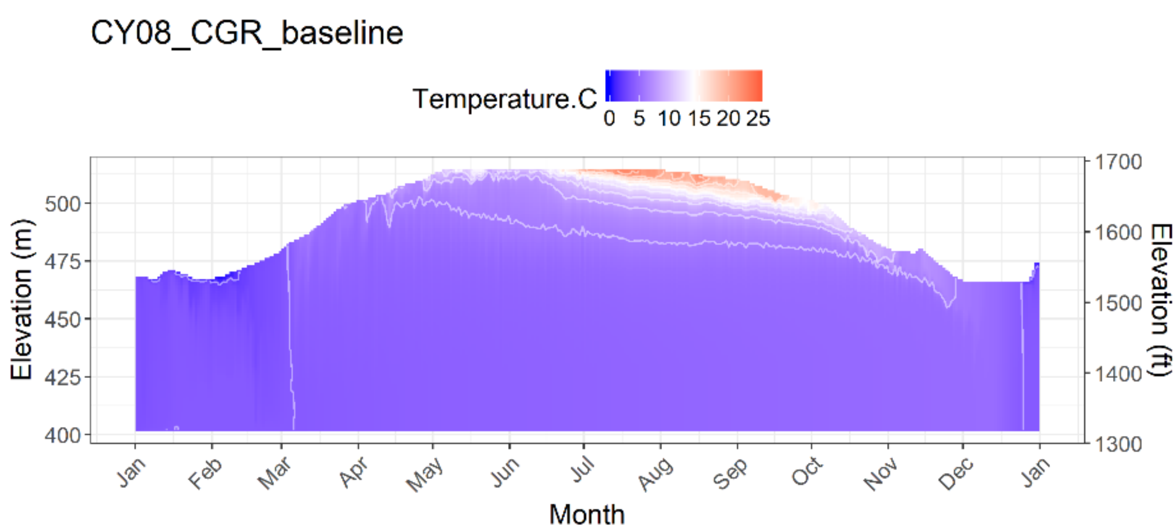


Figure 40. Lake elevation and water temperature (color) through 2008 under existing operations.

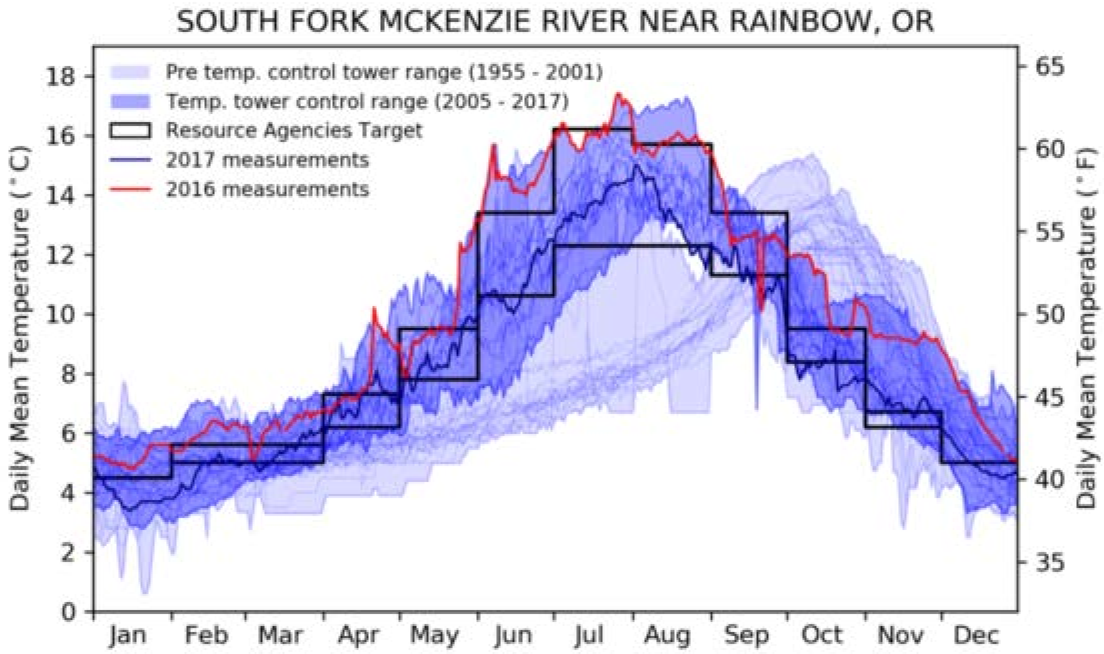


Figure 41. Cougar Reservoir Daily Mean 2016 and 2017 Outflow Temperatures Compared to Resource Agencies Target Temperatures and Temperature Ranges before (1955 – 2001) and during (2005 – 2017) WTCT Operation Years.

Since the completion of the WTCT, water temperature downstream of Cougar has resembled a more natural seasonal temperature change regardless of the water-year type and the maximum pool elevation. For example, a comparison of two low-water years, one before the WTCT construction (2001) and one after construction (2015), show downstream temperatures are warmer during the spring and cooler during the fall with WTCT in place (Figure 42) (USGS, 2017).

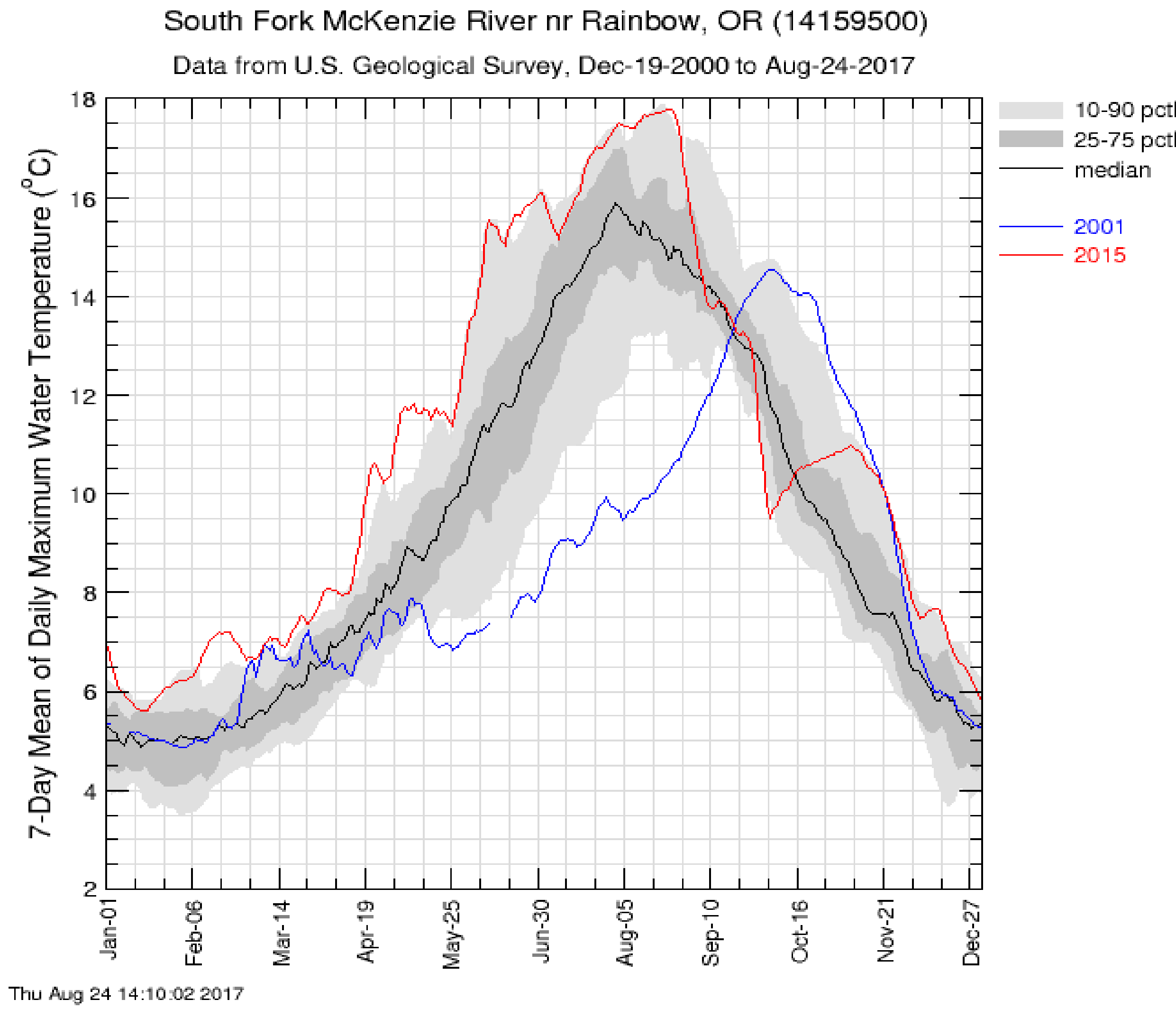


Figure 42. Comparison Water Temperature Downstream of Cougar Reservoir at USGS Site 14159500 during 2001 and 2015 Calendar Years (USGS, 2017).

Operating projects to optimize temperature conditions downstream for fish is often inconsistent with TMDL temperature targets, even with a temperature control tower such as the one constructed at Cougar Dam. Experience in implementing water temperature control operations in the South Fork McKenzie River downstream of Cougar Dam to achieve more normative water temperatures suggest that special site-specific considerations may be required for such actions with respect to achieving ODEQ TMDLs. An operational requirement for avoiding high temperature releases in the fall (i.e., during spring Chinook salmon incubation) is evacuating as much warm surface water as possible from the reservoir throughout the summer months to allow for cold-water releases during the fall. These real-time operations are typically within the range of the downstream temperature targets for fish agreed upon by multiple agencies (NMFS, USFWS, ODFW) throughout the year. In short, it is necessary to balance the effect of warm water temperatures downstream of the dam across spring, summer, and fall

periods to achieve the most appropriate overall biological effect. In the South Fork McKenzie River, the requirement resulted in summer water temperatures below Cougar Dam that were well above draft TMDLs identified by ODEQ during April through September (Figure 4.3-6) in order to provide more favorable temperatures during the critical incubation period in fall. A focus on achieving the cooler TMDL temperature targets during summer would have adversely affected the temperature conditions achievable during the fall spawning and incubation period for spring Chinook because Cougar Reservoir would have retained more warm surface water over summer.

By diverting water, EWEB's Leaburg Dam and Walterville diversion affect mainstem McKenzie River water temperatures. These two projects affect flows and water temperatures in a 5.8-mile stretch between Leaburg Dam and the confluence with the tailrace of the Leaburg powerhouse ("Leaburg bypass reach") and a 7.3-mile section between the intake for the Walterville powerhouse and the point of confluence with the Walterville tailrace ("Walterville bypass reach"). To prevent substantial adverse effects on migrating adult or rearing juvenile UWR spring Chinook, the Federal Energy Regulation Commission (FERC) license issued for the Leaburg-Walterville Project requires that EWEB maintain flows of 1,000 cfs in the 5.8-mile river reach bypassed by the Leaburg project and the 7.3-mile river reach bypassed by the Walterville project. Reducing flows to 1,000 cfs increases the river's response to summer heat. EWEB estimated that by reducing flows to 1,000 cfs in the McKenzie River's bypassed reaches, the Leaburg-Walterville project typically increased August water temperatures by about 0.7 °C during normal years (EA Engineering 1994). The water temperature model developed during the FERC relicensing process predicted that, in a worst-case (hot and dry) climatological scenario, water temperatures could become elevated by 2.7 and 3.6°F (1.5 and 2.0°C), respectively, at the lower end of each of the two mainstem bypass reaches (EA Engineering 1994). This may occasionally cause the water temperatures to exceed Oregon state standards.

3.14.2 Total Dissolved Gas

During November (1970), when yolk sac fry may have been present, Monk et al. (1975) measured TDG levels of 97.8% to 124.1% saturation near the base of Cougar Dam; 99.5% to 115.7% at a site 3,000 ft downstream; and 103.4% to 108.6% at a site 2.7 miles downstream. In April 2006, the Corps tested TDG under increasing spill from the Cougar Dam regulating outlet and turbine releases ranging from 0 to 530 cfs (Britton 2006). When regulating outlet releases reached 2,000 cfs, TDG exceeded 120% in the South Fork McKenzie just below the confluence of

the regulating outlet channel and the tailrace. Because greater depths compensate TDG,[7] Monk et al. (1975) estimated TDG at 100% at depths ranging from 0.8 to 2.2 meters. The risk of gas bubble trauma during dam spills would thus tend to be at the depth of redds constructed under the low flow conditions typical of the spring Chinook spawning season; however, juvenile Chinook nearer the water surface might be at risk. Sac fry at redd depth are at lower risk because of depth compensation. Levels of dissolved gases measured below Blue River Dam in March (1971 and 1972) ranged from 107.9% to 120.4% saturation. Symptoms of gas bubble trauma have not been reported in juvenile or adult anadromous salmonids in the McKenzie sub-basin.

3.14.3 Turbidity

Turbidity is generally very low in the South Fork and mainstem McKenzie rivers with background levels less than 5 Nephelometric Turbidity Units (NTU). Turbidity downstream of Cougar Dam is largely dependent on the magnitude of streamflows above/below the dam and the extent to which the river mobilizes the exposed bed sediments. Dam operators maintain outflows and reservoir levels in accord with requirements described in the Water Control Manual (USACE, 1963) and in other process and procedures documents. The dam consequently traps large particles and fine-grained sediments brought to the reservoir during low flow periods. The river transports little or no suspended sediment downstream during the spring and summer when Cougar Dam holds back water during conservation season for hydropower, water supply, and recreation. Hence, suspended sediment concentration (SSC) and turbidity levels in the South Fork McKenzie River below the dam are very low to negligible for seven-eights months of the year. Baseline turbidity levels in the South Fork McKenzie range from 0-10 NTU. In fall, when the Corps draws down the reservoir to minimum flood control pool in preparation for flood season, the fine-grained sediments (silts and clays) are resuspended and exported downstream, resulting in elevated turbidity above baseline SSC turbidity levels in the South Fork McKenzie. When the Corps draws down the reservoir for flood control season, the same areas of deltaic sediments and reservoir slopes potentially exposed to erosive flows from storm runoff remains unchanged from year to year. During winter storms (rainfall and snowmelt or rainfall only) and associated flood control releases, instantaneous peaks and short-term increases in SSC and turbidity occur in the South Fork McKenzie, though prolonged plumes are uncommon. Thus, during a four-month period from November - February, short-term moderate to high levels (relative to baseline values) of SSC and turbidity may be detected in the

[7] For example, Weitkamp, D.E., and Katz, M. A Review of Dissolved Gas Supersaturation Literature. Transaction of the American Fisheries Society 9:659-702, 1980. This paper notes that depth compensates for supersaturation at an approximate rate of 10%/meter of depth.

South Fork McKenzie River. Sediment plumes in the South Fork McKenzie can cause low to moderate increases in SSC and turbidity in the main stem McKenzie River as well.

In 2018, the Terwilliger fire in the South Fork McKenzie Basin burned 11,555 acres of forest around Cougar Reservoir. A mosaic burn with a few hot spots around Cougar Dam, the Terwilliger Fire could result in increased sediment and debris loading to the reservoir during the fall and winter of 2018 and into the future. High intensity fires consume organic matter that binds the soil together, can reduce the ability of the soil to absorb water, and also increase surface runoff. When combined, these factors can increase the frequency of debris flows that deliver large quantities of sediment into stream channels (Wissmar et al. 1994). Fire-associated landslides are capable of delivering large quantities of sediment in unharvested systems. Typically three to five years after a fire, gully formation (and failure) and slope failure (mass wasting) occur during storms with some frequency. The Corps expects that sediment transport from the basin would reach a peak over the next three to five years and sediment yield may remain elevated for years. Even though sediment delivered to reservoir would increase, normal flood control operations would release approximately the same SSC at both winter pool and lowered project pool elevations. Additionally, USFS and the Corps plan to implement measures to reduce impacts from the fire, including slope stabilization, road repair, and fuels management.

3.14.4 Algae

During a typical summer, algal communities grow in Cougar Reservoir during June - September with varying peak timing and bio-volume from year-to-year. Current understanding relates the timing and size of algal blooms in Cougar Reservoir as largely dependent on nutrient loading to the lake during the previous wet-season (fall-winter-spring), relative abundance of sunlight, and the onset of full pool lake elevation. The typical blue-green algae species that can dominate is *Aphanizomenon flos-aquae*. This species can produce the cyanotoxin cylindrospermopsin,[8] a toxin that can damage the liver and kidney. There has only been one recorded case of this toxin found in the northwest. Salem public works found barely measurable amounts of this toxin in samples at their water supply facility on August 1, 2018. EWEB collects algae speciation and toxin data each summer. Since 2007, harmful algal bloom advisories have been issued at Cougar Reservoir in one (2011) out of the last 10 years.

3.14.5 Other water quality parameters of concern

The ODEQ's 2002 CWA section 303(d) database does not indicate that any streams in the McKenzie sub-basin are water quality limited due to excess nutrients. The ODEQ's 2002 CWA

[8] https://www.epa.gov/nutrient-policy-data/cyanobacteriacyanotoxins#what2

section 303(d) database does not indicate that any streams in the McKenzie sub-basin are water quality limited due to toxics.

Sediment and water quality sampling during WTCT construction revealed DDT and its byproducts in the reservoir sediments. Other water quality parameters of concern, such as metals and pesticides, were below established concern levels (Hains 2000, USACE 2003). The high downstream turbidity and detection of DDT in exposed reservoir sediment raised questions regarding the potential for export of sediment and DDT downstream of the project. DDT is highly toxic to aquatic life and the potential for mobilization caused concern. However, downstream movement of DDT and byproducts of DDT were low immediately following the April 2002 event during the WTCT drawdown and nonexistent during later storm events (Anderson 2007, USACE 2003). Anderson (2007) hypothesizes that the reservoir acted as a trap for sediment and DDT throughout the course of its existence, facilitating degradation of the trapped DDT, and may have been a source for both during the construction period in 2002–05, but the lack of detection during storms indicates that DDT transport was small. Although fine sediments were found among stream substrates downstream from Cougar Dam, all other stream reaches affected by flow regulation showed similar fine sediment accumulations leading the study team to suspect that the cause was primarily peak flow reduction associated with flood control operations, not the 2002 sediment-plume episode (USACE 2003).

In 2002, USGS Oregon Water Science Center began working with EWEB to monitor dissolved pesticides in the McKenzie River at the EWEB drinking water intake and upstream, and in tributaries draining to the McKenzie. Results from McCarthy and Alvarez (2014) indicate that low concentrations of several polycyclic aromatic hydrocarbons and organohalogen compounds are consistently present in source waters, and that many of these compounds are present in finished drinking water. The nature and patterns of compounds detected suggest that land-surface runoff and atmospheric deposition act as ongoing sources of polycyclic aromatic hydrocarbons, some currently used pesticides, and several legacy organochlorine pesticides.

3.14.6 Environmental Consequences

The Corps used the following three scenarios to assess the impacts of the alternatives on water quality:

- "*Baseline*" represents the existing conditions and the No Action Alternative with a functional WTCT at Cougar Dam, effectively skimming surface water to a depth of about 12 ft - the model is calibrated to existing conditions, where some leakage exists through the existing weir gates in the temperature control tower (approximately 30% of total outflow) (USACE, 2018).

- "*FSS*" represents operation of the proposed FSS (post construction operations of Alternative 2), effectively skimming surface water to a depth of 25 ft deep from the cul-de-sac of Cougar Reservoir and releasing downstream through the existing wet well in the WTCT at Cougar Dam - this scenario assumes that Corps would install brush seals to mitigate any additional leakage through the weir gates caused by additional head differential within the wet well caused by the connection and operation of the FSS to the WTCT.
- "*1,450 Pool*" represents a constant pool elevation of 1,450 ft (construction conditions for Alternative 2) in which the diversion tunnel (centerline elevation 1,293 ft) is used year round as the primary release outlet through the dam.

3.14.6.1 Alternative 1. No Action

Under the No Action Alternative, dam operators would continue to maintain outflows and reservoir levels in accordance with requirements described in the WCM (USACE, 1964b) and in other process and procedures documents. The Corps would continue to operate the WTCT to meet downstream temperature and TDG targets. No changes to other water quality parameters are expected.

Sediment releases from the dam would remain at baseline levels. The river transports little or no suspended sediment downstream during the spring and summer. Hence, SSC and turbidity levels in the South Fork McKenzie River below the dam would continue to be low to negligible for seven-eight months per year. For flood season, the reservoir is drawn down to minimum flood control pool, and the same areas of deltaic sediments and reservoir slopes potentially exposed to erosive flows from storm runoff remains unchanged from year to year. During winter storms (rainfall and snowmelt, or rainfall only) and associated flood control releases, instantaneous peaks and short-term increases in SSC and turbidity may occur in the South Fork McKenzie, while prolonged plumes would remain uncommon. Thus, during a four-month period from November - February, short-term moderate to high levels (relative to baseline values) of SSC and turbidity may be detected in the South Fork McKenzie River. Sediment plumes in the SF McKenzie can cause low to moderate increases in SSC and turbidity in the main stem McKenzie River as well.

In 2018, the Terwilliger fire in the South Fork McKenzie Basin burned 11,555 forest acres around Cougar Reservoir. A mosaic burn with a few hot spots around Cougar Dam, the Terwilliger Fire could result in increased sediment and debris loading to the reservoir during the fall and winter of 2018 and into the future. High intensity fires consume organic matter that binds the soil together, can reduce the ability of the soil to absorb water, and can increase surface runoff. When combined, these factors can increase the frequency of debris flows that

deliver large quantities of sediment into stream channels (Wissmar et al. 1994). Fire-associated landslides are capable of delivering large quantities of sediment in unharvested systems. Usually three to five years after a fire, gully formation (and failure) and slope failure (mass wasting) occur with some frequency during storms. The Corps expects that sediment transport from the basin would reach a peak in the next three to five years and sediment yield may remain elevated for years. However, although sediment delivered to the reservoir would increase, normal flood control operations would release approximately the same SSC at both winter pool and lowered project pool elevations. Additionally, USFS and the Corps plan to implement measures to reduce impacts from the fire, including: slope stabilization, road repair, and fuels management.

3.14.6.2 Alternative 2. Floating Screen Structure with Trap and Haul

Under Alternative 2, when the Corps would drawdown Cougar Reservoir, there would be negligible to moderate short-term impacts on water quality, only experienced during the single year. These include:

- Moderate impact to water temperature with cooler temperatures during June - July and warmer temperatures during late September - November especially during a hot-dry year (e.g., 2001). These temperatures will resemble pre-dam conditions;
- Negligible to no impact to TDG as the diversion tunnel will be used during the drawdown and use of the diversion tunnel has not shown past TDG increases;
- Minor increases in turbidity with instantaneous peaks and up to three weeks of elevated turbidity during storm events similar to turbidity levels typical of winter storm events; and
- Minor increase in algal blooms, although there is limited data available to predict exact trends in algal blooms.

Temperature

To assess the potential impacts of the proposed action to water temperature, four calendar-year scenarios were used to simulate water temperature over a range of hydrologic and meteorological conditions in Cougar Reservoir using the CE-QUAL-W2 model (Cole and Wells, 2015; USACE, 2018). Hydrology in four separate calendar years were simulated in HEC RES-SIM (Threadgill et. al, 2012). Conditions from the following years were simulated: 2001 representing a hot-dry year, 2004 and 2006 representing relatively normal conditions, and 2008 representing relatively cool and wet conditions. Figure 43 - Figure 46 show lake elevation and in-lake water temperature (color) for each calendar-year simulation of a fixed elevation 1,450 ft pool (2001, 2004, 2006, and 2008). Simulated release temperatures from Cougar Dam in 2001 (Cy01), 2004 (CY04), 2006 (CY06), and 2008 (CY08) with a constant pool elevation of 1,450 ft are compared to

baseline (No Action) and FSS (Alternative 2) conditions in Figure 47. Simulated temperatures under the long-term operation of the FSS are predicted to be cooler in June and September - October compared with baseline (No Action) due to the deeper depth from the lake surface at which lake water is released through the dam. At a constant pool elevation of 1,450 ft, Cougar Reservoir and the South Fork McKenzie River downstream of Cougar Dam may experience warmer temperatures during late September - November, especially during a hot-dry year (e.g., 2001), and cooler temperatures during June - July when compared to baseline (No Action) or FSS scenarios.

Following the drawdown to elevation 1450 ft, when the reservoir returns to minimum flood control pool (elevation 1,532 ft), the Corps expects temperatures not to differ from the Alternative 1 (No Action) or Alternative 2 (FSS) as thermal conditions in the lake and downstream are well-mixed and relatively cool from December-March (comparing Figures 44-47 with Figures 38-41).

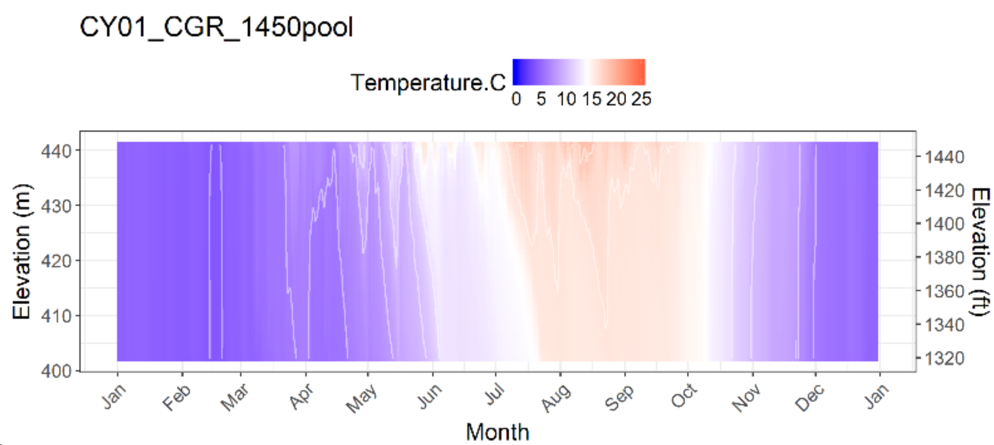


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Figure 43. Lake elevation and water temperature (color) through 2001 under the 1,450Pool scenario.

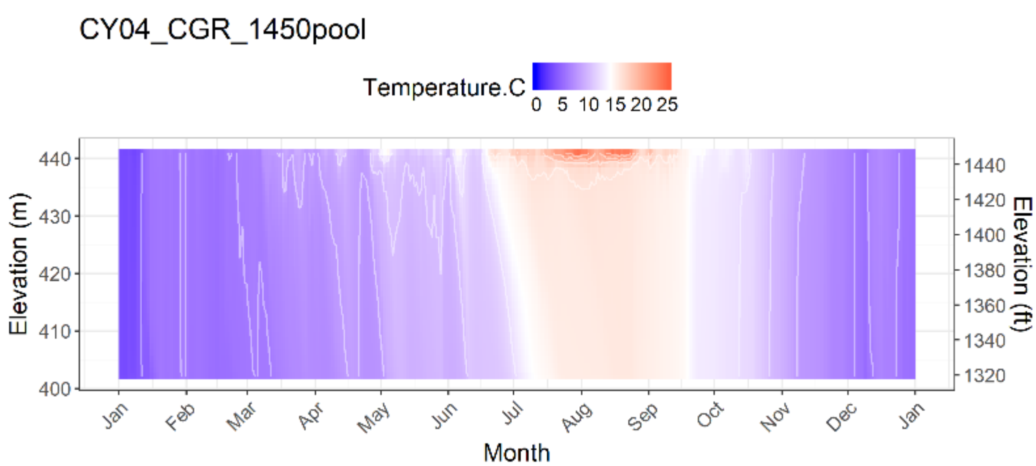

Figure 44. Lake elevation and water temperature (color) through 2004 under the 1,450Pool scenario.

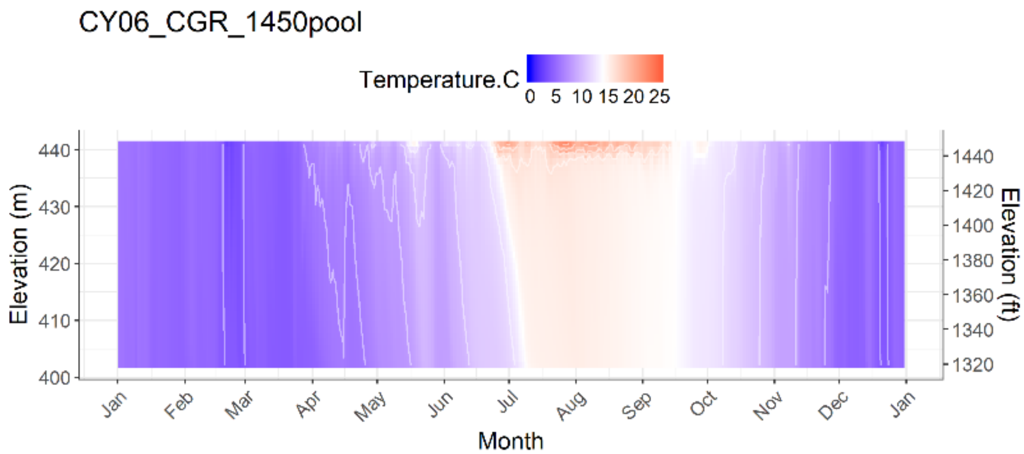

Figure 45. Lake elevation and water temperature (color) through 2006 under the 1,450Pool scenario.

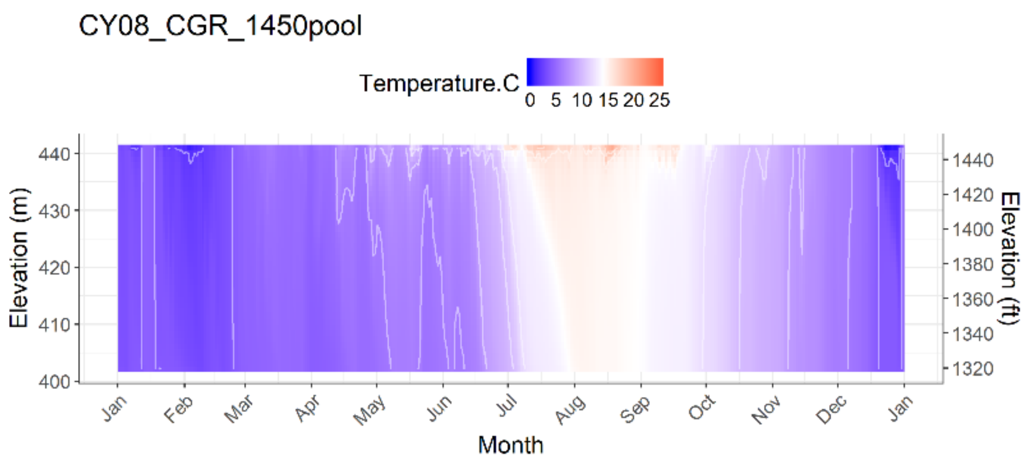

Figure 46. Lake elevation and water temperature (color) through 2004 under the 1,450Pool scenario.

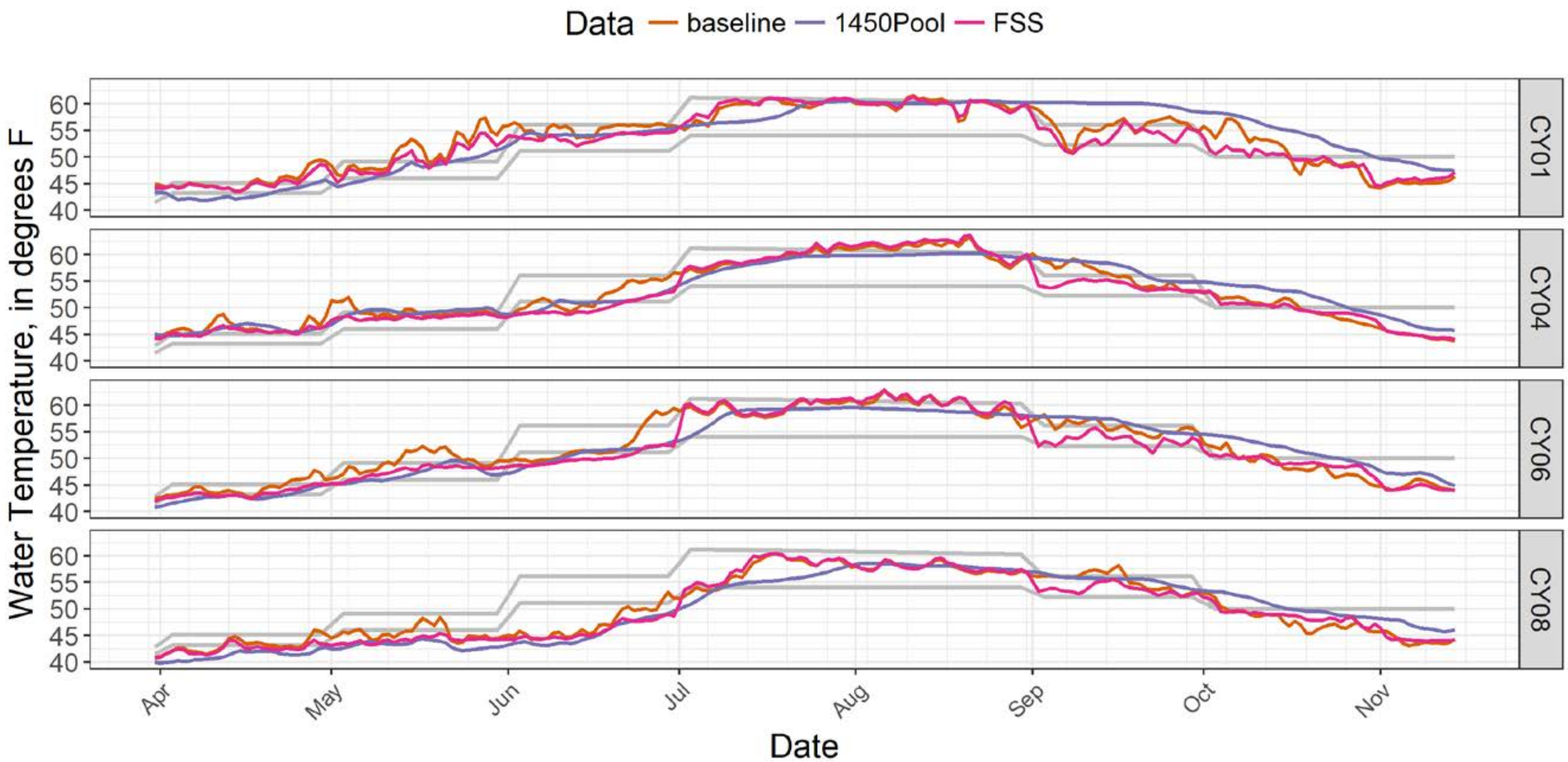

Figure 47. Simulated release temperatures from Cougar Dam in 2001 (CY01), 2004 (CY04), 2006 (CY06), and 2008 (CY08) under three separate scenarios: baseline (no action), 1,450Pool (constant pool elevation of 1,450 ft year-round), and FSS (with future Floating Screen Structure). Grey line represents the temperature target agreed upon by multiple agencies.

Total Dissolved Gas:

Past Corps water quality monitoring has shown that RO releases between 500 and 700 cfs can produce TDG production above the 110% Oregon State water quality standard below Cougar Dam. For this reason, USGS installed a permanent and real-time TDG sensor in 2012 at the USGS Cougar gaging station (CGRO) in the South Fork McKenzie River (near Rainbow) downstream of Cougar Dam (Figure 48). This gaging station reports continuous TDG data. Along with temperature, flow, and stage data, USGS publishes real-time TDG data on their publically accessible website.[9]

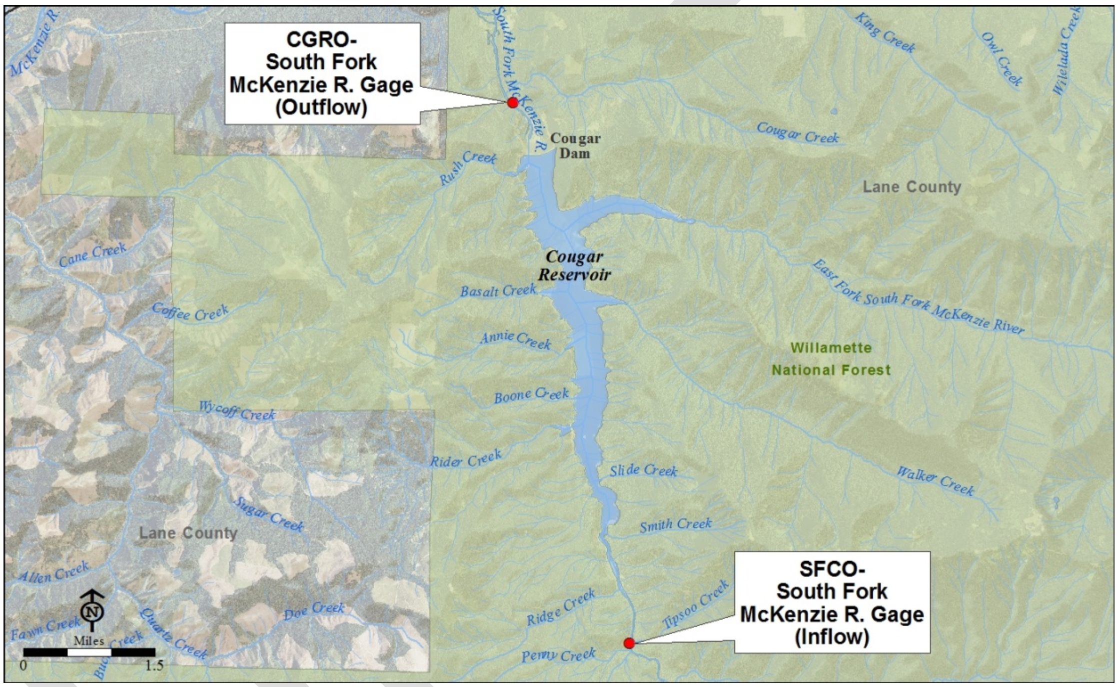

Figure 48. Water Temperature United States Geological Survey (USGS) gage locations: Upstream and downstream of Cougar Reservoir on South Fork of McKenzie River. TDG was also collected downstream.

The Corps has shown TDG exceedances resulting from RO use to release flows through Cougar Dam. The Corps demonstrated this during a drawdown performed in 2016 for repairs at Cougar. The 2016 drawdown provides a close proxy for conditions experienced under the Alternative 2 proposed drawdown and lessons learned from the 2016 drawdown have informed which outlets the Corps would use during the proposed drawdown under Alternative 2. On December 17, 2015, the Corps discovered debris entrained in the Cougar turbine units, which caused damage. When the debris was discovered, the Corps discontinued outflow through the powerhouse, utilizing the RO to release flow. To perform repairs, the Corps needed to draft down the Cougar reservoir from minimum conservation pool elevation (1,532 ft) to approximate elevation of 1,455 ft, when it typically would refill. The Corps utilized the RO to

[9] USGS: https://waterdata.usgs.gov/nwis/inventory?agency_code=USGS&site_no=14159500

drawdown the reservoir until March 3, at which point the Corps began diversion tunnel operations to continue the drafting down the reservoir. Diversion tunnel operations continued from March 3 to April 20.

In Figure 49, the resulting 2016 downstream Cougar Reservoir TDG percent saturation is plotted against project outflows including total, powerhouse, and RO releases. Throughout the majority of the year, TDG levels were below the Oregon State water quality standard of 110% saturation. During April - mid-October, the 15-minute TDG saturation levels averaged 101.8%, with a peak of 109% for a few hours in May. Despite meeting Oregon State TDG criteria for most of the year, the South Fork McKenzie River exceeded the water quality standards below Cougar Dam for a two-month duration at the beginning and end of the year. The 2016 drawdown exceedances occurred between January 14 - March 03 with an average 15-minute TDG saturation level of 115.6%, with a peak of 120% saturation from January 29 through January 30. These levels correspond to when the Corps utilized the RO exclusively to release outflows (Figure 49). During these RO operations and corresponding TDG exceedances, a daily maximum of 3,110 cfs was released through the ROs and on January 29 resulted in an average peak 15-minute TDG saturation level exceedance of 119.9%. TDG saturation levels dropped below State exceedance levels in early March (Figure 49). This drop in TDG coincides with the beginning of diversion tunnel operations on March 03. During the proposed drawdown for the project, the Corps would draw down the reservoir to an elevation of 1,450 ft exclusively using the diversion tunnel. The Corps would hold the reservoir level at elevation 1,450 ft for 6 - 12 months and the Corps would continue to release flows through Cougar Dam through the diversion tunnel during this time.

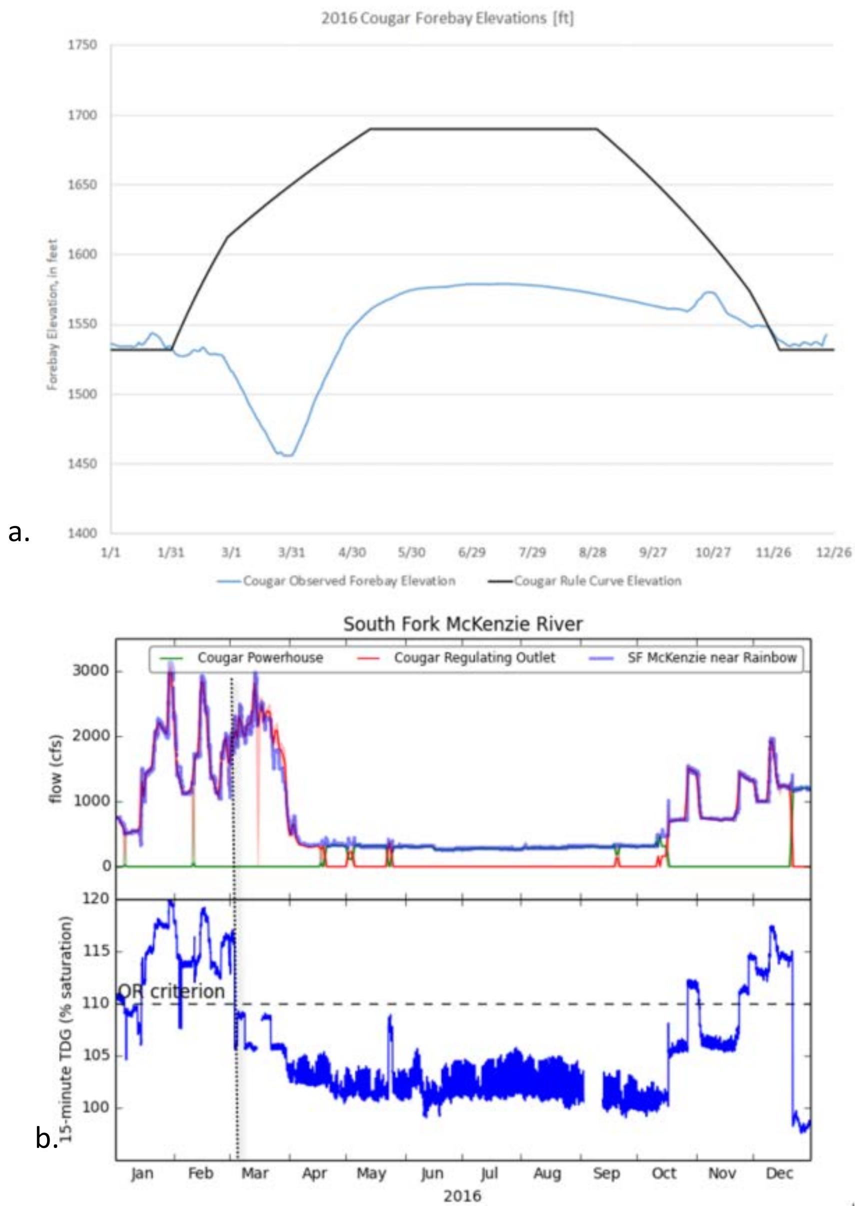

Figure 49. a. Cougar Dam operations (observed reservoir levels and outflows) and b. subsequent downstream TDG Saturation (15-Minute), 2016.

Turbidity

Under Alternative 2, the proposed drawdown would affect sediment transport and geomorphology up and downstream of Cougar Dam. In the reservoir, the placement of approximately 15,000 cubic yards of rock on the lower portion of the existing road on the upstream face of Cougar Dam may increase turbidity in the Reservoir. However, this increase in turbidity would of short duration as the material to be placed is primarily rock and would settle quickly. Additionally, this increase in turbidity would be localized to the area around the road in the forebay. During drawdown and when the Corps holds the reservoir level at below historic operating minimums, the sediment from the reservoir bottom and banks (including the former

channel and floodplain) not normally directly exposed to runoff and erosive flows, may be mobilized and transported downstream. The drawdown would subject sediments on the reservoir bottom to scour and expose reservoir slopes to both sheet and concentrated flows from runoff. The result of erosion of deltaic sediments and degradation of reservoir slopes would be an increase in the rate of sediment transported downstream. Consequently, there would be an increased rate of sediment transport from the reservoir to downstream of Cougar Dam. Additionally, at the time construction would start, sediment transport from the basin resulting from the Terwilliger fire will reach a peak and sediment yield may remain elevated for years. Increased sediment transport may cause elevated turbidity in the South Fork McKenzie River and McKenzie River below the confluence of the two streams (RM 59.7). However, due to the Corps ability to enable lake levels to rise during a storm event and potentially allow time for fine sediments to settle out, sediment release rates from Cougar Dam because of Alternative 2 would likely be similar to the No Action Alternative.

Evidence from the two previous deep drawdowns of Cougar Reservoir, described below, supports this assumption. The first deep drawdown of Cougar Reservoir occurred from 2002-2004 for the construction of the WTCT. The initial drawdown in 2002 to 1,400 ft elevation resulted in high rates of sediment transport from the reservoir and high turbidity levels in areas downstream of Cougar Dam. As a result of these impacts, the Corps instituted mitigation measures including limiting future drawdowns to 1,450 ft and monitoring turbidity downstream of Cougar Dam during any proposed drawdown to document suspended sediment impacts and potentially help to reduce these impacts. The Corps implemented these mitigation measures and successfully addressed sediment transport and turbidity concerns for the remainder of the WTCT construction as well as during the 2016 emergency trash rack repairs.

<u>WTCT Construction Drawdown (2002-2004)</u>

In 2002, Cougar Reservoir was drawndown for the WTCT construction and the pool maintained at a lower level until Fall 2004. Both the Corps and USGS monitored the effects of the drawdown on sediment transport and documented their observations and results (USACE, 2004); (USGS, 2007). Beginning in early February 2002, Cougar Reservoir was lowered to 1400 ft, about 130 ft below the minimum flood control pool elevation, exposing a large area of deltaic sediments (reservoir bottom) to high velocities for the first time in nearly four decades (since dam construction). The initial reservoir drawdown caused instantaneous and short-term increases in SSC and turbidity downstream of the dam. However, storms that occurred during the drawdown and lowered pool periods caused prolonged intervals of increased SSC and turbidity. A three-day storm in April 2002 caused widespread incision and bank sloughing of deltaic sediments and, subsequently, substantial increases in the transport rate of primarily fine-grained particles downstream. The increase in transport rate resulted in a three-month

period of considerable elevations in both SSC and turbidity levels (average value - 50 NTU) in the South Fork McKenzie below the dam. Winter storms in December 2002, January 2003, and January 2004 caused high SSC and turbidity in the South Fork McKenzie, albeit at lower levels than the April 2002 storm and over much shorter periods (two to four weeks). Of note, a Rush Creek diversion outlet pipe failure occurred concurrent with a storm on January 30, 2003. The slope failure caused an immediate spike in the turbidity downstream of the reservoir of 1,030 NTUs on January 30, 2003. Following the initial elevated turbidity resulting from the failure, the Corps raised the pool to 1,450 ft to cover the eroding slope below Rush Creek outlet. The turbidity level dropped to 450 NTUs within one day and fell to 83 NTUs by February 3, 2003. While the slope failure caused an immediate spike, channel down cutting and migration by the South Fork McKenzie from January 30 to 31, 2003, resuspended a large amount of sediment contributing to the high turbidity observed downstream (O'Brien et al., 2003).

The prolonged period of high SSC and turbidity releases in 2002 resulted in elevated SSC and turbidity in the main stem McKenzie River downstream of the confluence. The City of Eugene reported that treatment costs increased in Spring and Summer 2002 due to an increase in turbidity at their water filtration plant located at Hayden Bridge on the McKenzie River. The City did not report whether they had increased filtration costs (due to turbidity) during the final two years of lowered reservoir levels. Figure 50 shows time-series turbidity and discharge for the South Fork McKenzie downstream of Cougar Dam. Figure 51 shows turbidity and discharge on the McKenzie River at Vida during the WTCT construction period. The relation between turbidity levels shown on Figure 51 and turbidity releases from Cougar Dam are uncertain as Blue River joins the McKenzie River upstream of the Vida gage.

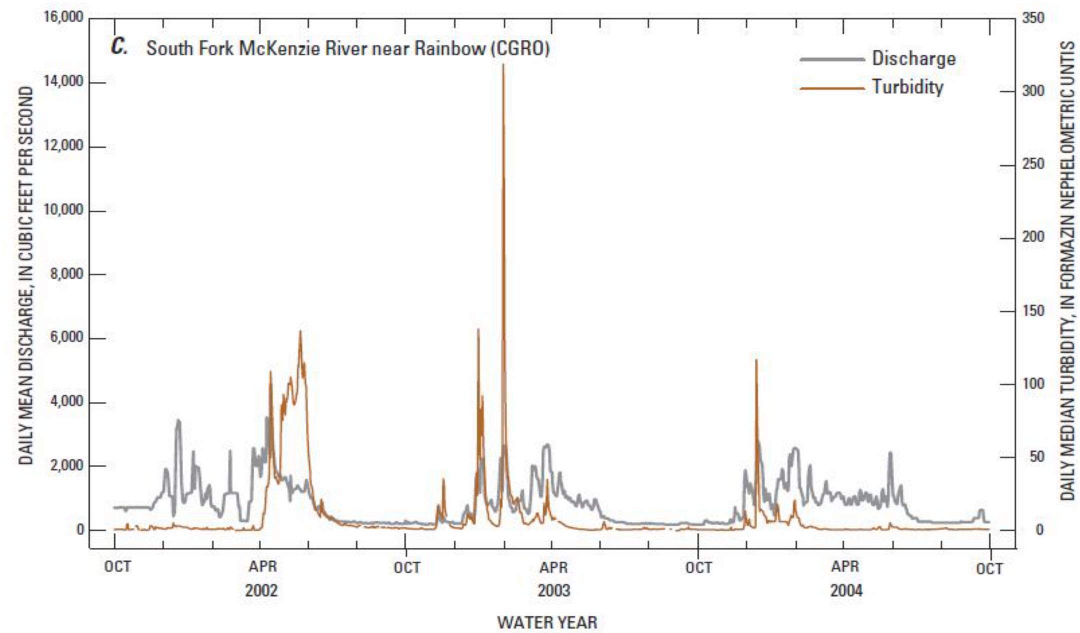

Figure 50. Discharge and turbidity on SF McKenzie River downstream of the Cougar Reservoir.

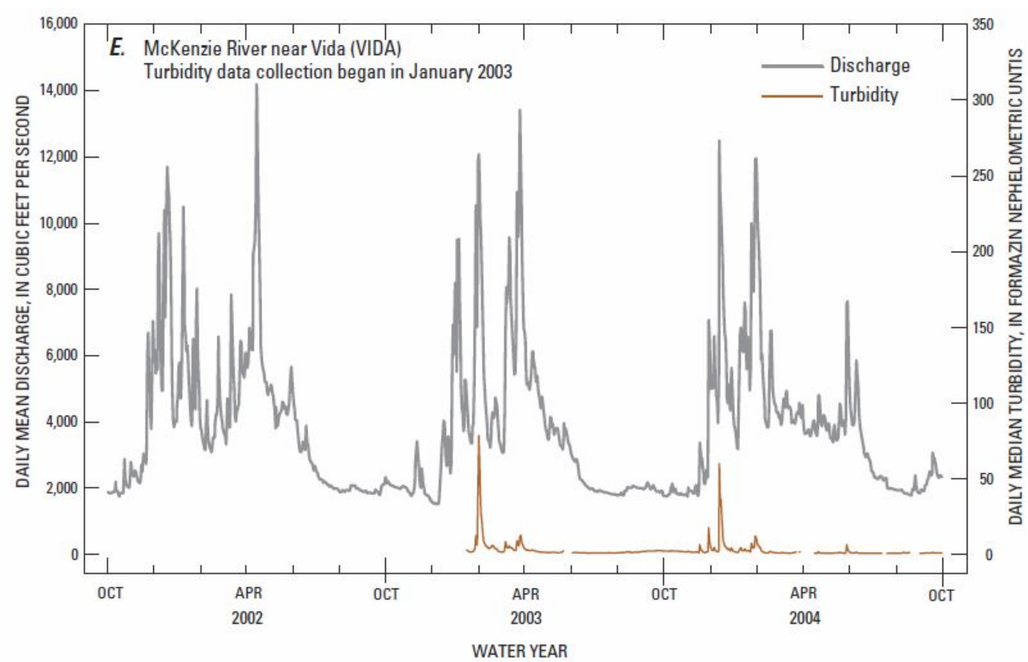

Figure 51. Discharge and turbidity on McKenzie River downstream of SF McKenzie confluence (turbidity and inflow from both Blue River and SF McKenzie River recorded at Vida gage).

During storms, both Corps and USGS personnel observed runoff and fluctuating pool elevations causing sloughing and sliding (mass wasting), and incision and denudation of exposed reservoir slopes. However, the exposed reservoir sides consist of much coarser material than

found in the reservoir bottom. The Corps observed that the majority of the material carried to the lowered pool either settled or transported only short distances as bed load. A small fraction of the sediment eroded from reservoir slopes consists of silts and clays. The river transported these fine-grained sediments downstream in suspension. Irrespective of the extent and number of slope failures and level of denudation, investigators concluded that the bulk of the sediment load mobilized by storm runoff resulted from reconfiguring and incision of deltaic sediments.

The drawdown carried an estimated 17,000 tons of sediment past the dam in 2002. In each successive water year, the volume of sediment carried past the dam and into the South Fork McKenzie declined. For 2004, the last year of lower pool elevation, the annual load was 24% of sediment released in 2002. Both USGS and Corps investigators attributed decreasing sediment loads to stabilization of the channels and floodplain by vegetation and the establishment of equilibrium channel configurations in deltaic sediments.

The extended period of elevated turbidity raised questions about potential effects on spawning gravels, juvenile and adult spring Chinook salmon, and macroinvertebrate communities that are integral to the Chinook salmon food web. As a result, the Corps contracted with researchers from Oregon State University's Department of Geosciences and the USFS' Pacific Research Station to answer the following questions:

1. To what extent and depth have fine sediments associated with the reservoir drawdown intruded into South Fork McKenzie gravels below the dam?
2. How much sediment released from the reservoir traveled in suspension through the McKenzie system?
3. How much sediment released from the reservoir settled out of suspension and was still stored in the sub-basin?

Some fine-grained suspended sediment carried past the dam deposited in the South Fork McKenzie (Stewart et al., 2002). The Corps and USGS observed a settled layer of fine-grained sediments covering streambed sands and gravels in the South Fork McKenzie Rivers after the April 2002 storm, but higher releases from the dam resuspended that material. While USGS monitored accumulation of fine-grained sediment downstream of the dam during the drawdown period, they had insufficient data to report depths of accumulation. However, investigators estimated low to moderate amounts of silts and clays settling in the South Fork McKenzie River in 2002 as well as decreasing quantities in each successive years; they also reported that material remained settled throughout the year, but noted moderate releases from the dam would likely mobilize settled silts and clays.

The Corps also collected samples of benthic invertebrates above and below Cougar Reservoir in August 2002 following the high turbidity events of Spring 2002. The Corps designed the sampling to determine whether there had been immediate and catastrophic effects to benthic macroinvertebrate communities because of the recent drawdown and release of suspended materials. The analysis indicated that the "biotic integrity"[5] of the benthic macroinvertebrate community below Cougar Dam was degraded when compared to the community located above the reservoir (USACE 2003). However, before the 2000 and 2001 drawdown, the Corps observed the same trend in collected samples. The Corps stated that this effect is usual for areas located below dams, citing studies in the Clackamas River system as an example.

Cougar Reservoir Drawdown (2016)

In early 2016, Cougar Reservoir was drawndown from minimum conservation pool elevation (1,532 ft) to approximate 1455 ft for emergency trash rack repairs from February - April (Figure 49a). Turbidity was monitored continuously during the drawdown at USGS gage located in the South Fork McKenzie River near Rainbow, OR (CGRO/USGS #14159500), from February - November. On March 3rd, outflow shifted from using the RO exclusively to a combination of the RO and diversion tunnel. This continued through April 1st. During this time, there was a large rain event which caused a brief spike in turbidity (i.e., up to 39 FNU on March 3rd). Turbidity levels soon settled out to levels ranging from 5 to < 10 FNUs (Figure 52).

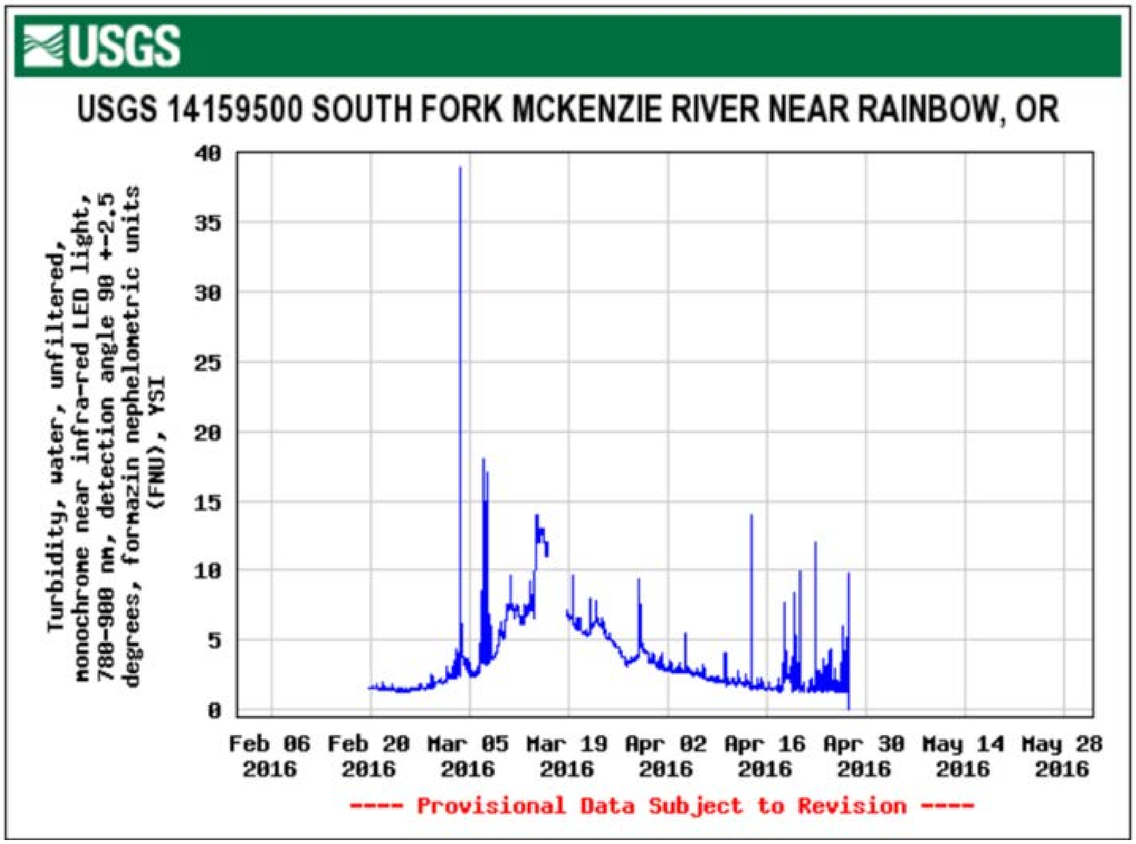

Figure 52. Turbidity Measured Downstream of Cougar Dam during Emergency Penstock Trash Rack Repairs.

In summary, during the initial drawdown and following period of lowered reservoir level operation, deltaic sediment would be suspended and transported downstream. For construction of Alternative 2, the proposed reservoir drawdown level is 1,450 ft versus 1400 ft for the WTCT Project. As a result, the drawdown would expose a much lower area of deltaic sediments (reservoir bottom) to erosional forces during periods of high runoff. Therefore, the sediment load and associated SSC and turbidity would be substantially less than amounts and levels measured during construction of the WTCT in 2002-2004. The 2016 drawdown to 1,450 ft demonstrates this. Additionally, investigators attributed only small to negligible increases in downstream SSC and turbidity to erosion of reservoir slopes during the 2002-2004 drawdown and he drawdown under Alternative 2 would expose less of the reservoir side slopes than were exposed in 2002-2004. Furthermore, the total exposure time of sediments to high flows is at most a single year as compared to several years for the WTCT construction. Finally, at the time of drawdown for the WTCT Project, Cougar Dam had been operating and accumulating sediment for nearly 40 years. In addition, USGS and Soil Conservation Service (now the Natural Resources Conservation Service) estimated that up to five times the annual sediment load of the South Fork McKenzie River was brought to the reservoir over a period of three to five days in mid-December 1964 (USGS 1966) (SCS 1965). Thus, the WTCT Project drawdown subjected a considerable volume of sediment, which included accumulation from an extreme event, to

mobilization and downstream transport. The quantity of deltaic sediment available for downstream transport would be considerably less at the start of reservoir drawdown and FSS construction: 17-18 years of sediment deposition versus nearly 40 years, and absent an extreme transport event.[10]

The total annual load for Alternative 2 construction might be approximately 4,000 to 10,000 tons, quantities measured in the later stages of the WTCT Project, but not of the magnitude seen during initial drawdown and lowered pool operations in 2002. The sediment releases decreased nearly 60% from 2003 to 2004, despite the fact that annual releases during 2004 increased by almost 50% from 2003. The prolonged period of high turbidity measured at the beginning of drawdown following a spring storm in 2002 is unlikely to occur as well. Given that prolonged periods of high turbidity in the South Fork McKenzie are unlikely, the formation of plumes, as was reported in the main stem McKenzie River in April - June 2002, is also not expected. The expected (or predicted) sediment transport condition during the year or more of construction of the FSS is instantaneous peaks in SSC and turbidity during winter storms, and low to moderately elevated above baseline levels of both parameters for periods of two to three weeks. As this would be far less than the turbidity levels seen during the WTCT construction, the impacts would be less than those experienced during the WTCT construction.

As was seen following the high turbidity events in 2002 and 2003, the Corps anticipates that moderate releases from the dam would likely mobilize silts and clays that may settle because of the slightly elevated turbidity associated with the drawdown and limit the impacts to spawning gravels and benthic communities. For Alternative 2, the Corps would monitor turbidity downstream of Cougar Dam during construction to document suspended sediment impacts. Deposition of fine-grained sediment downstream of Cougar Dam would be negligible, and increased turbidity and associated increases in water treatment costs, reported by EWEB for their Hayden Bridge Filtration Plant in mid-2002, are not expected.

At FSS completion, Cougar Dam would resume normal operations and sediment transport conditions would be as described for the No Action Alternative.

Algae

While it is difficult to predict the magnitude and distribution of algae blooms in Cougar Reservoir under the proposed action, the Corps hypothesizes that any increased mobilization of sediment during the drawdown period could result in an increased algal population in the following summer season. Algae enumeration data collected by USACE September 21, 2004,

[10] The extremely high sediment releases in Willamette Basin tributaries during the December 1964 flood were principally ascribed to anthropogenic causes, specifically widespread clear-cutting, and improper design of logging roads. Legislated changes in forestry practices have eliminated the catastrophic basin-wide loss of sediment that occurred during the 1964 flood.

when the Corps held the reservoir at approximately 1,450 ft, show an algae bloom that consisted primarily of *Aphanizomenon flos-aquae*. This species can produce the cyanotoxin Cylindrospermopsin, but there are no recorded cases of this in the northwest to date. The Corps hypothesizes that the bloom was due in part to additional sediment load from the erosion of exposed riverbanks at lower water elevation. These sediments could have provided extra nutrients (nitrogen and phosphorus) to feed the algal bloom in Cougar Reservoir. However, it is unclear as to whether these algae produced toxins because algal toxin data during the 2004 drawdown do not exist.

Other water quality parameters of concern

The Corps expects no changes to other water quality parameters under Alternative 2.

3.15 WILDLIFE

Wildlife species in the study area are typical of those commonly found on the west slope of the Cascades. Both game and nongame species are present Including big-game animals such as Roosevelt elk (*Cervus Canadensis roosevelti*), black-tailed deer (*Odocoileus hemionus columbianus*), black bear (*Ursus americanus*), and cougar (*Puma concolor*). Upland game birds include sooty grouse (*Dendragapus fuliginosus*), ruffed grouse (*Bonasa umbellus*), mountain quail (*Oreortyx pictus*), and band-tailed pigeon (*Patagioenas fasciata*). Furbearers include North American beaver (*Castor Canadensis*), raccoon (*Procyon lotor*) and, less commonly, North American river otter (*Lontra Canadensis*), bobcat (*Lynx rufus*), and mink (*Neovison vison*). The Corps identifies special status species within operating projects such as the WVS under Engineering Regulation 1130-2-540. Sensitive status species include:

- any species listed, or proposed for listing as threatened or endangered by the USFWS or NMFS under the provisions of the ESA;
- any species covered under the migratory bird treaty act;
- any species designated by USFWS as a “candidate”, “listing” species, or “sensitive species”; and
- any species that is listed and protected by state statute in a category implying potential endangerment or extinction (ER 1130-2-540).

Table 5 outlines the sensitive status species known to occur within or near the action area (Oregon Biodiversity Information Center, 2016).

Table 5. Wildlife Sensitive Species List for McKenzie sub-basin from Cougar Reservoir to the confluence with the Willamette River. This list includes wildlife species listed as Endangered or Threatened for Lane County, Oregon. (This list does not include fish species considered sensitive which are covered under the aquatic species section.)

Common Name	Scientific Name	Federal Status*	Critical Habitat	Protective Regulations	State Status
Amphibians					
Oregon spotted frog	*Rana pretiosa*	Threatened	Designated	79 FR 51657 81 FR 29335	Sensitive Critical
Clouded salamander	*Aneides ferreus*		Not Designated		Sensitive Vulnerable
Western pond turtle	*Actinemys marmorata*	Under Review	Not Designated		Sensitive Critical
Northern red-legged frog	*Rana aurora*	SOC	Not Designated		Sensitive Vulnerable
Coastal tailed frog	*Ascaphus truei*	SOC	Not Designated		Sensitive Vulnerable
Cascade torrent salamander	*Rhyacotriton cascadae*		Not Designated		Sensitive Vulnerable
Western Painted turtle	*Chrysemys picta bellii*		Not Designated		Sensitive Critical
Oregon slender salamander	*Batrachoseps wrighti*	SOC	Not Designated		Sensitive Vulnerable
Western toad	*Anaxyrus boreas*		Not Designated		Sensitive Vulnerable
Cascades Frog	*Rana cascadae*	SOC	Not Designated		Sensitive Vulnerable
Short-tailed albatross	*Phoebastria (Diomedea albatrus)*	Endangered	Designated	65 FR 46643	
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Designated	43 FR 17710	
Loggerhead sea turtle	*Caretta caretta*	Endangered	Designated	45 FR 29054	
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened	Designated	45 FR 29054	
Green sea turtle	*Chelonia mydas*	Threatened	Designated	50 CFR 20058	
Birds					
Yellow-billed cuckoo	*Coccyzus americanus*	Threatened	Proposed	79 FR 71373	Sensitive Critical
Western snowy (coastal) plover	*Charadrius nivosus nivosus*	Threatened	Designated	53 FR 45788 77 FR 63727	Threatened

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Common Name	Scientific Name	Federal Status*	Critical Habitat	Protective Regulations	State Status
Northern spotted owl	*Strix occidentalis caurina*	Threatened	Designated	55 FR 26114 77 FR 71875	Threatened
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	Designated	75 FR 3424 76 FR 61599	Threatened
Streaked horned lark	*Eremophila alpestris strigata*	Threatened	Designated	78 FR 61452 78 FR 61506	Sensitive Critical
Bald eagle	*Haliaeetus leucocephalus*		Not Designated		Sensitive Vulnerable
American peregrine falcon	*Falco peregrinus anatum*		Not Designated		Sensitive Vulnerable
White-tailed kite	*Elanus leucurus*		Not Designated		
Northern goshawk	*Accipiter gentilis atricaupillus*	SOC	Not Designated		Sensitive Vulnerable
Olive-sided flycatcher	*Contopus cooperi*	SOC	Not Designated		Sensitive Vulnerable
Pileated woodpecker	*Dryocopus pileatus*		Not Designated		
Harlequin duck	*Histrionicus hitrionicus*	SOC	Not Designated		Sensitive Vulnerable
Lewis's woodpecker	*Melanerpes lewis*	SOC	Not Designated		Sensitive Critical
Golden-crowned kinglet	*Regulus satrapa*		Not Designated		
Rufous hummingbird	*Selasphorus rufus*		Not Designated		
Barrow's goldeneye	*Bucephala islandica*		Not Designated		
Purple martin	*Progne subis*	SOC	Not Designated		Sensitive Critical
Bufflehead	*Bucephala albeola*		Not Designated		
Mammals					
North American wolverine	*Gulo gulo luscus*	Proposed Threatened	Not Designated		Threatened

Table 5. Wildlife Sensitive Species List for McKenzie sub-basin from Cougar Reservoir to the confluence with the Willamette River. This list includes wildlife species listed as Endangered or Threatened for Lane County, Oregon. (This list does not include fish species considered sensitive which are covered under the aquatic species section.)

Common Name	Scientific Name	Federal Status*	Critical Habitat	Protective Regulations	State Status
Red tree vole	*Arborimus longicaudus*	Candidate	Not Designated		
Yuma myotis	*Myotis yumanensis*	SOC	Not Designated		
Western gray squirrel	*Sciurus griseus*		Not Designated		Sensitive Vulnerable
Brazilian free-tailed bat	*Tadarida brasiliensis*		Not Designated		
Ringtail	*Bassariscus astutus*		Not Designated		Sensitive Vulnerable
White-footed vole	*Arborimus albipes*	SOC	Not Designated		
Pacific marten (interior)	*Martes caurina* (pop. 1)		Not Designated		Sensitive Vulnerable
Hoary bat	*Lasiurus cinereus*		Not Designated		Sensitive Vulnerable
Townsend's big-eared bat	*Corynorhinus townsendii*	SOC	Not Designated		Sensitive Critical
Fringed myotis	*Myotis thysanodes*	SOC	Not Designated		Sensitive Vulnerable
Little brown myotis	*Myotis lucifugus*		Not Designated		
Insects					
Oregon silverspot butterfly	*Speyeria zerene hippolyta*	Threatened	Designated	45 FR 44935	
Fender's blue butterfly	*Icaricia icarioides fenderi*	Endangered	Designated	65 FR 3875 71 FR 63862	
Plants					
Bradshaw's desert-parsley	*Lomatium bradshawii*	Endangered	Designated	51 FR 38448	
Nelson's checker-mallow	*Sidalcea nelsoniana*	Threatened	Designated	58 FR 8235	
Golden paintbrush	*Castilleja levisecta*	Threatened	Designated	62 FR 31740	
Water howellia	*Howellia aquatilis*	Threatened	Designated	59 FR 35860	

Table 5. Wildlife Sensitive Species List for McKenzie sub-basin from Cougar Reservoir to the confluence with the Willamette River. This list includes wildlife species listed as Endangered or Threatened for Lane County, Oregon. (This list does not include fish species considered sensitive which are covered under the aquatic species section.)

Common Name	Scientific Name	Federal Status*	Critical Habitat	Protective Regulations	State Status
Willamette daisy	*Erigeron decumbens*	Endangered	Designated	65 FR 3875 71 FR 63862	
Whitebark pine	*Pinus albicaulis*	Candidate	Not Designated		
Kincaid's lupine	*Lupinus sulphureus* ssp *kincaidii*	Threatened	Designated	65 FR 3875 71 FR 63862	

** Species of Concern (SOC) are those species about which NMFS or USFWS has concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under ESA.*

Along with the sensitive status species listed above, a variety of common small mammals occur in various project area habitats, including several species of squirrels, chipmunks, mice, and rabbits. Small populations of waterfowl inhabit the river, reservoir, and riparian areas, including mallards, common mergansers, and wood ducks. In compliance with the National Forest Management Act, WNF has a forest management plan that includes consideration of sensitive species and biological diversity. Eleven sensitive wildlife species are known to occur in WNF. Five of these species - red-legged frog, bald eagle, American peregrine falcon, northern spotted owl, and harlequin duck - can reasonably be expected to occur near the project or immediate downstream locations. Many species of non-game birds inhabit the area. A 1973 survey found over 70 species within ½ mile of Cougar Reservoir (USACE, 1973). Various salamanders and frogs, including the northern red-legged frog (also a candidate species under ESA), inhabit the South Fork McKenzie (Forest Service, 1992).

3.15.1 Environmental Consequences

3.15.1.1 Alternative 1. No Action

Under No Action Alternative, there would be no direct impacts on sensitive species. Fish prey for bald eagles would not benefit from additional fish passage within Cougar Reservoir and within the McKenzie River sub-basin.

3.15.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Under Alternative 2, minor, short-term duration effects on wildlife are expected. Table 6 provides a summary of Alternative 2 effects including the determination of no impacts, beneficial impacts, or may adversely impact individuals (MAII - will not result in a loss of species

viability within the action area, or result in a potential for federal listing). Table 6 also provides a brief summary of the rational used to make the determination effects for each species.

Table 6. Summary of effects under the proposed Alternative 2 for sensitive species that occur or have potential habitat in the McKenzie River sub-basin, from the South Fork McKenzie River downstream to the confluence with the Willamette River.

Common Name	Effects Determination	Rationale For Determination
Amphibians/Reptiles		
Clouded salamander	No Impact	Preferred habitat (late successional old growth coniferous forest) would not be impacted by the proposed action
Western pond turtle	Beneficial Impact (if woody debris is distributed downstream); No Impact (otherwise)	Species has been observed in the South Fork McKenzie downstream of Cougar Dam and also within the mainstem of the McKenzie River. Woody debris, collected at the project, may be placed downstream of Cougar Dam increasing available basking habitat and provide nutrients to prey species within the McKenzie River
Northern red-legged frog	MAII	Species have been observed within Cougar Reservoir. During drawdown, some tadpoles may be trapped in shallow depressions. There is potential that adults or tadpoles will become entrapped within the FSS during operation.
Coastal tailed frog	No Impact	Very unlikely to occur in the project area. Prefers small streams with fast flow and cool water temperatures. Potentially found in tributaries to Cougar Reservoir that would not be impacted by this project.
Cascade torrent salamander	No Impact	Very unlikely to occur in the project area. Prefers small streams with fast flow and cool water temperatures. Potentially found in tributaries to Cougar Reservoir that would not be impacted by this project.
Painted turtle	No Impact	A population was recently discovered within the lower McKenzie River near Springfield, Oregon. No anticipated impact to this species.
Oregon slender salamander	No Impact	Very unlikely to occur in the project area. Prefers small streams with fast flow and cool water temperatures. Potentially found in tributaries to Cougar Reservoir that would not be impacted by this project.
Western toad	MAII	Species have been observed within Cougar Reservoir. During drawdown, some tadpoles may be trapped in shallow depressions.
Birds		
Bald eagle	Beneficial Impact	Fish prey would increase
American peregrine falcon	No Impact	No nesting habitat impacted, minor changes to prey base may occur during construction but would not result in increase or decline

White-tailed kite	No Impact	Very unlikely to occur in the project area. Only recorded observance is near the confluence of the McKenzie River and the Willamette River. Typical habitat includes open meadows and prairie within the Willamette Valley.
Common Name	**Effects Determination**	**Rationale For Determination**
Northern goshawk	MAII	No nesting habitat impacted, minor changes to prey base may occur during construction and staging but would not result in increase or decline
Olive-sided flycatcher	No Impact	No nesting habitat impacted during construction and staging.
Pileated woodpecker	No Impact	No nesting habitat impacted during construction and staging.
Harlequin duck	No Impact	Species has not been observed within the project area in recent years. Last survey was in 2012 (USFS) with no observations within the McKenzie mainstem or S. Fork McKenzie River
Golden-crowned kinglet	MAII	No nesting habitat during construction and staging. Staging area at Slide Creek Campground and North Sunnyside may impact local individuals
Rufous hummingbird	MAII	No nesting habitat during construction and staging. Staging area at Slide Creek Campground and North Sunnyside may impact local individuals
Barrow’s goldeneye	MAII	Low water levels in the fall and winter may affect individuals in migration.
Purple martin	No Impact	Very unlikely to occur in the project area.
Bufflehead	MAII	Low water levels in the fall and winter may affect individuals in migration.
Mammals		
Yuma myotis	MAII	The risk of affecting this species is very low. Proposed action would not preclude Yuma myotis from using the area.
Western gray squirrel	MAII	The risk of affecting this species is very low. Proposed action would not preclude Western gray squirrel from using the area.
Ringtail	MAII	Species has been observed to use the Cougar bypass tunnel. Any disturbance during construction or dewatering of the reservoir would be temporary.
White-footed vole	No Impact	Preferred habitat is within riparian areas with dense thickets of alder and hazel. While these tree species are present within the project area, no impacts to these species are anticipated.

Pacific marten (interior)	MAII	Very unlikely to occur in the project area. Construction within the staging area may affect individuals. Any disturbance would not preclude marten from using the area in the future.
Common Name	Effects Determination	Rationale For Determination
Hoary bat	MAII	The risk of affecting this species is very low. Proposed action would not preclude hoary bat from using the area.
Townsend’s big-eared bat	MAII	The risk of affecting this species is very low. Proposed action would not preclude Townsend’s big-eared bat from using the area.
Little brown myotis	MAII	The risk of affecting this species is very low. Proposed action would not preclude Little brown myotis from using the area.

Construction Impacts: The Corps anticipates the drawdown would affect some amphibian species throughout the construction of Alternative 2. During the drawdown process, some salamander species, northern red-legged frogs, and Western toads in localized may be trapped. Prior to initial drawdown of Cougar Reservoir, the Corps project biologists will support, through recovery and rescue, any wildlife that may become trapped during the Cougar Reservoir drawdown.

Cougar Reservoir does not provide optimal breeding habitat for many of the amphibian species observed within the area due to the typical operations of reservoir water levels. Red-legged frogs require ponds to breed from February - April in areas that have little to no flow. These species would be restricted to the southern portion of the reservoir in isolated areas, and the Corps expects impacts to these semi-aquatic species to last more than one year.

The Corps expects noise due to construction activities at the existing temperature control tower to impact wildlife in adjacent areas. Construction noise may affect migratory birds present within the area during breeding season. Although the Corps would perform work over 30 months beginning in July 2020, work in the first six months would most likely occur offsite including preconstruction submittals, material procurement, and metal fabrication to occur during the months prior to the drawdown. Therefore, the Corps does not expect construction activities affecting breeding birds to last more than one breeding season. Due to the 2018 Terwilliger Fire impacts, habitat for breeding migratory songbirds may have decreased near Slide Creek Campground, North Sunnyside, and the WTCT.

Removal of vegetation within the North Sunnyside or Slide Creek Campground areas for staging would result in a potential habitat loss within these areas. The 2018 Terwilliger Fire has also affected both sites, negatively affecting forested habitats within the Cougar Reservoir. The Corps expects a reduction in occurrence for many of the species listed in the table above.

Grading within either Slide Creek Campground or North Sunnyside area for staging would potentially affect small, unnamed seasonal tributaries to the South Fork McKenzie River; however, impacts would not result in a loss of riparian habitat since the affected area is within the Cougar Reservoir pool away from the riparian zone.

Operations: Operations of the FSS may result in incidental capture of amphibians within Cougar Reservoir. Typically, amphibians in all age classes (e.g., tadpoles, adults) are usually located along the shoreline where water temperatures are typically higher and within the preferred thermal tolerance of the species. Both adult and juveniles amphibians may occasionally transit the open water of Cougar Reservoir. If these amphibians transit the open water near the FSS, there may become entrapped within the FSS. If amphibians are captured within the FSS, they will be released as soon as possible to nearby shoreline habitat.

The Corps would float debris collected at the FSS and the debris booms over to the access road located on the face of Cougar Dam in order to transfer it to a disposal location. Placement of the woody debris could occur downstream of Cougar Dam to augment the ongoing USFS South Fork McKenzie restoration project located downstream of Cougar Dam. The placement of woody debris in various size classes would provide additional habitat and nutrients to the South Fork McKenzie and within the McKenzie River Sub-basin as a whole. Large pieces of woody debris would provide habitat features such as basking structures for native turtle species found within the McKenzie River Sub-basin. Smaller woody debris would contribute to the overall health of the McKenzie River Sub-basin.

3.16 VEGETATION

The study area (McKenzie River Sub-basin from Vida upstream and including the forested watersheds of Cougar Reservoir) is within the Western Cascade Province, Western hemlock zone (Franklin and Dyrness, 1973). The dominant tree species in this area is the Douglas fir, although Western hemlock is the climax species. Predominant coniferous tree species include Western red cedar, incense cedar, noble fir, Pacific silver fir, and grand fir. Associated woody plants include red whortleberry, Cascades mahonia, salal, Pacific rhododendron, and American devil's club. Much of the watershed has been managed for timber; thus, clear-cut areas in various stages of regeneration are obvious. Douglas fir is the predominant species for replanting after harvest.

The McKenzie mainstem has a vegetation fringe on the north side, including old-growth trees and various riparian species. Pasture and vegetation associated with rural residential areas are more prominent on the northern shore. The south side is less developed and more heavily vegetated than the northern shore. Large Western red cedar, Douglas fir, shrubs and herbaceous plants grow along the river (Corps, 1973). Vegetation associated with the Douglas fir forests is typical of the low-elevation Western Oregon Cascade Range, with salal, Oregon grape, bracken and sword ferns, vine maple, and hazel. Flood plain and high water table areas adjacent to the McKenzie and tributaries include alder, cottonwood, big leaf maple, and devil's club (BLM, 1993). Rooted aquatic macrophytes are also present in the ecosystem. These groups provide the nutrients and cover for the higher organisms and are important to the well-being of the ecosystem.

The South Fork McKenzie Basin below Cougar Dam supports a variety of plant life in various stages of succession. Portions of this area have been logged in the past and active logging operations are scattered throughout the Sub-basin and both private and public lands. Riparian and wetland vegetation, typical of western Oregon, includes cottonwood, willow, alder, cattail, bulrush, horsetail, water milfoil, water buttercup, and pondweeds. Numerous species of forbs, grasses, shrubs, and ferns form understory or ground cover. Coniferous forest, including old growth, is a component of the flood plain, with Douglas-fir, Western hemlock and Western red cedar most abundant. Pacific yew and incense cedar also occur. Oregon oak has been found on drier benches (USFWS, 1979).

Table 7 provides the sensitive status plant (including fungus and non-vascular) species known to occur within or near the action area (Oregon Biodiversity Information Center, 2016).

Table 7. Plant Sensitive Species List for McKenzie sub-basin from Cougar Reservoir to the confluence with the Willamette River.

Common Name	**Scientific Name**	**Federal Status**	**State Status**
Plants			
Shaggy horkelia	*Horkelia congesta* ssp. *congesta*	SOC	Candidate
Wayside aster	*Eucephalus vialis*	SOC	Threatened
Thompson mistmaiden	*Romanzoffia thompsonii*		Sensitive
Adder’s-tongue	*Ophioglossum pusillum*		Sensitive
Columbia lewisia	*Lewisia columbiana* var.		Sensitive
Drooping bulrush	*Scirpus pendulus*		Sensitive
Kellogg’s dwarf rush	*Juncus kelloggii*		Sensitive
Alaskan single-spiked sedge	*Carex scirpoidea* var.		Sensitive
Fungus			
Brown-eyed shingle lichen	*Pannaria rubiginosa*		Sensitive
Cabbage lung lichen	*Lobaria linita*		Sensitive

Common Name	Scientific Name	Federal Status	State Status
Charred matchstick lichen	*Pilophorus nigricaulis*		Sensitive
Fungus spp.	*Choiromyces venosus*		Sensitive
Fungus spp.	*Gomphus kauffmanii*		Sensitive
Lichen spp.	*Pseudocyphellaria mallota*		Sensitive
Seaside horsehair lichen	*Bryoria subcana*		Sensitive
Slender stalked helvetta	*Helvella elastica*		Sensitive
Lichen ssp.	*Hypotrachyna riparia*		Sensitive
Nonvascular Plants			
Banded cord-moss	*Entosthodon fascicularis*		Sensitive
Comb notchwort	*Anastrophyllum minutum*		Sensitive
Liverwort spp.	*Porella bolanderi*		Sensitive
Liverwort spp.	*Blepharostoma arachnoideum*		Sensitive
Moss spp.	*Orthotrichum hallii*		Sensitive
Platyhypnidium moss	*Platyhypnidium riparioides*		Sensitive
**Species of Concern (SOC) are those species about which USFWS has concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under ESA.*			

At the time of writing this document, the 2018 Terwilliger Fire has affected approximately 11,555 acres within the South Fork McKenzie Sub-basin (Figure 53). The fire has affected the vegetation surrounding the majority of Cougar Reservoir including Slide Creek and Sunnyside Campgrounds and areas south of the East Fork South Fork McKenzie River along the eastern side of Cougar Reservoir. On the western side of Cougar Reservoir, lands south of Rush Creek to the west of Slide Creek Campground are impacted.

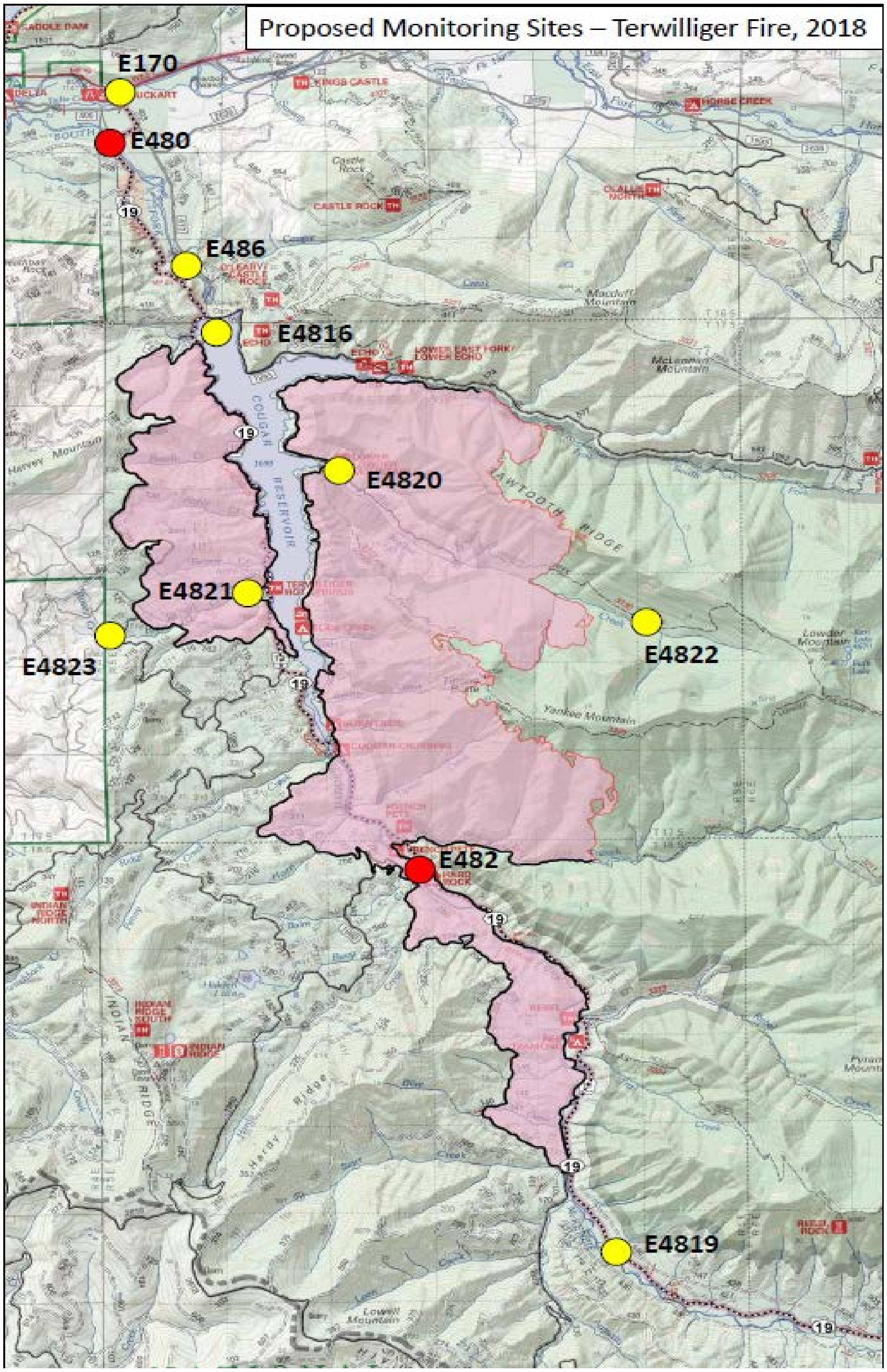

Figure 53. Terwilliger Fire extent (red shading).

3.16.1 Environmental Consequences

3.16.1.1 Alternative 1. No Action

The No Action Alternative would have no direct impacts on vegetation within the proposed action area.

3.16.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Impacts to vegetation would be minor and of short-term duration. Impacts to native vegetation would include removal of herbaceous vegetation, trees, and shrubs within the proposed construction areas of Slide Creek Campground or North Sunnyside. Some clearing of vegetation may occur within the existing switchback roadway located adjacent to the emergency spillway. The vegetation impacts would be minimal as the route lacks soil, having been constructed within the quarry used for dam construction. Trees and shrubs found within this area requiring removal are typically small in stature and sporadically scattered throughout the route. There are no anticipated vegetation impacts near the existing WTCT. During drawdown, the Corps expects that some herbaceous and grassy vegetation would grow within the exposed lakebed. It is unknown what species would be present at this; however, the species would most likely constitute a mixture of native species that are adapted to early seral habitat and invasive species considered. It is unlikely that any of the sensitive species identified above would be present in the lakebed during drawdown.

3.17 Fish and Aquatic Species

Cougar Reservoir provides habitat that supports a variety of aquatic species typical of a lake environment, including resident trout and bull trout populations.

The McKenzie River supports diverse populations of anadromous and resident fish and aquatic organisms. Anadromous fish species include UWR Chinook salmon and Pacific lamprey. Resident native cold-water species include bull trout, rainbow, cutthroat, and mountain whitefish. Brook trout have been introduced into the Sub-basin and are widely distributed. Other resident native species include northern pikeminnow, largescale sucker, chiselmouth, redside shiner, brook lamprey, and a variety of sculpins and daces. Native Oregon chub, listed under the ESA in 1993 and officially delisted in 2015, are found only in the Willamette River Basin in floodplain habitats with little or no water flow. However, Oregon chub are not in the immediate project area, with the nearest known population occurring in the lower McKenzie River upstream of Hedrick’s Bridge (Bangs, 2018). Common warm water non-native species include white and black crappie, largemouth bass, and brown bullhead. Pacific lamprey (*Entosphenus tridentatus*), a native anadromous fish and species of concern, were historically

widely distributed in the Willamette River Basin including the reach of the South Fork McKenzie upstream of the location of Cougar Dam (Luzier et al. 2011, USFWS 2018 in review). Pacific lamprey are known to be present in the reach downstream of Cougar Dam (Schultz et al. 2015). Adult lamprey carcasses have been observed in the stilling basin at the dam base (D. Gartletts, personal communication); however, no adult lamprey have been collected in the Cougar Dam adult collection facility's presort pool since facility opening in 2010. USFWS's Pacific Lamprey Conservation Assessment (Luzier et al. 2011, USFSWS 2018 in review) identified several factors associated with USACE dams that are thought to limit distribution and abundance of Pacific lamprey within the Basin, including passage, flow alterations, and water quality. Dam passage is considered a key threat in the Willamette River Basin. Since 2010, the Confederate Tribes of Grande Ronde have been investigating efficacy of translocating adult Pacific lamprey from Willamette Falls to above Fall Creek Dam. This reintroduction effort was intended as a test case for potential application in other tributaries within the basin.

Although no studies of aquatic communities in the McKenzie River have been completed, the McKenzie River likely contains an abundance of invertebrate species including crayfish, snails, stoneflies, mayflies, and caddisflies as well as a variety of micro and macro algae species.

3.17.1 Environmental Consequences

3.17.1.1 Alternative 1. No Action

The No Action Alternative would likely see no measurable change to the abundance, habitat or behavior of resident fish like Oregon chub and trout or other aquatic species.

3.17.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

The construction activities associated with Alternative 2 may have moderate, short-term effects on resident fish above and below Cougar Dam related to changes in flow and temperature as well as risk of entrainment or reservoir stranding. These impacts would be similar in nature to those analyzed for bull trout and UWR Chinook salmon in Section 3.18 and are not likely to pose a high risk to overall abundance and distribution. Construction activities may also have moderate, short-term effects on other aquatic species residing within the reservoir because of the year-long drawdown.

Successful implementation of Alternative 2 would also benefit resident species by increasing habitat connectivity, spatial distribution, and gene flow between populations of resident fish above and below the dam. There would also be monitoring for non-native fish in the fish facility with the opportunistic ability to remove non-native fish encountered as bycatch.

3.18 Threatened and Endangered Species

The 1973 ESA (16 U.S.C. 1531 et seq.), as amended, provides for the conservation and recovery of endangered and threatened species and the ecosystems upon which they depend. USFWS and NMFS share joint jurisdiction for the administration of ESA-listed species. Under ESA Section 7, federal agencies are required to evaluate the effects of actions they fund, permit, or authorize and consult with USFWS and/or NMFS to ensure federal actions would not jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat (defined as specific geographic locations critical to the existence of a threatened or endangered species). The following sub-sections describe the threatened and/or endangered species present in the action area, and the designated critical habitats upon which they depend.

3.18.1 Species under NMFS Jurisdiction

One Pacific salmonid species occurs in the project area: UWR Chinook salmon (*Oncorhynchus tshawytscha*). In September 2005, NMFS designated critical habitat for these species (70 Federal Register [FR] 52630): critical habitat for Chinook is found within the project area. The UWR Chinook salmon ESU was listed as threatened on March 24, 1999 (64 FR 14308), and threatened status was reaffirmed on June 28, 2005 (70 FR 37160). The ESU includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River, as well as the populations in the Willamette River and its tributaries upstream of Willamette Falls, Oregon. The ESU also includes spring-run Chinook salmon from six artificial propagation programs, including the McKenzie River Hatchery Program (Oregon Department of Fish and Wildlife (ODFW) Stock #23). Historically, this ESU spawned in several tributaries of the Willamette River, including the Clackamas, Pudding, Mollala, Calapooia, Santiam, McKenzie and Middle Fork Willamette River Sub-basins. Construction of the WVS dams, inclusive of Cougar Dam, blocked access to large swaths of historical spawning habitat.

The McKenzie Sub-basin contains seven watersheds occupied by this ESU; these watersheds encompass approximately 1,339 mi2 and 1,251 stream miles. Fish distribution and habitat use data from ODFW identify approximately 268 miles of occupied riverine habitat in the watersheds (ODFW 2003a,b). Myers et al. (2003) identified one demographically independent population (McKenzie River) in this sub-basin, likely the only self-sustaining population above Willamette Falls, and possibly in the entire ESU (Myers et al. 2003, NMFS 2003). NMFS has classified the McKenzie River Chinook salmon as both a core population (historically abundant and “may offer the most likely path to recovery”) as well as a genetic legacy population (one of the “the most intact representatives of the genetic character of the ESU”) (McElhany et al. 2003). Likewise, ODFW considered the McKenzie River as essential habitat for spring Chinook salmon (ODFW 1993 as cited in Bastasch et al. 2003).

Critical habitat for UWR Chinook salmon ESU was designated on September 2, 2005 (70 FR 52630) and includes the South Fork McKenzie from its mouth upstream to a point upstream of Cougar Reservoir (coordinates 43.9533, -121.9995) (Figure 54). Primary constituent elements of critical habitat identified by NMFS that occur in the project area are as follows:

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

(2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

(3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover.

UWR Chinook salmon spawning migration in the South Form McKenzie River is generally from May - October, with peak migration in June. Detailed information on the seasonal timing of key life stages of Chinook salmon in the South Fork McKenzie River is provided in the EDR and incorporated by reference (USACE 2017). In the South Fork McKenzie and throughout the South Willamette, UWR spring Chinook may spawn from mid-August - October, with peak spawning from September - mid-October. The period of egg incubation through fry emergence extends from September - March and downstream juvenile migration peaks from November - June, but begins as early as October lasting until July (ODFW 2003).

The Oregon Fish Commission estimated, historically, that the largest run of UWR Chinook salmon into the McKenzie River Sub-basin for which it had data was one of approximately 46,000 adults in 1941. The Oregon Fish Commission based this on the assumption that 39% of UWR Chinook salmon adults counted passing over Willamette Falls were bound for the McKenzie Sub-basin (Mattson 1948, USACE 1995). Estimated run sizes of UWR spring Chinook returning to the McKenzie Sub-basin from 1945-1960 averaged 18,000 adults (USACE 1995). In 1958 , a run of 4,300 adult Chinook escaped to spawn in the South Fork alone (USFWS 1959).

Given that NMFS previously saw this population as a stronghold of natural production in the ESU (NMFS 2016), an apparent decline in the status of the McKenzie River demographically independent population in the last 10 years is a source of concern. Within-sub-basin contributors to this risk include habitat degradation associated with Corps dams, land use, and the ecological and genetic effects of a very large fish hatchery program within the Sub-basin. ODFW (2005) estimates that dams have blocked 16% of the population’s historical habitat. In

the absence of effective passage programs, spawning areas would continue to be confined to more lowland reaches where land development, water temperatures, and water quality may be limited (NMFS 2016). Pre-spawning mortality levels are generally high in the lower tributary where water temperatures and fish densities are generally the highest. Areas immediately downstream of high head dams may also be subject to high levels of TDG (NMFS 2016). High quality habitats remain accessible in significant portions of the Sub-basin not blocked by dams, but habitat degradation apparently extirpated a spawning aggregate in the Mohawk watershed a century ago (Parkhurst et al. 1950), and historically-significant rearing habitat in the upper Willamette River mainstem has been lost or damaged. Potentially catastrophic events that could unfavorably affect the population include landslides, hatchery related disease epidemics, and pollution discharges from roadway/transportation spills (McElhany et al. 2003).

Recent comprehensive spawner surveys (redds and carcasses) have been conducted in the North Santiam, South Santiam, McKenzie, and Middle Fork Willamette Rivers by ODFW (NMFS 2015). Direct adult counts are also made at Willamette Falls, Bennett Dam, and Minto Fish Facility (North Santiam); Foster Fish Facility (South Santiam); Leaburg and Cougar Dams and the McKenzie Hatchery (McKenzie River); and Fall Creek Dam and Dexter Fish Facility (Middle Fork Willamette River). Intermittent spawner surveys have been conducted in the Molalla and Calapooia Rivers. Carcasses are assessed for origin (hatchery/natural) based on external marks and otoliths marks, and females are assessed for the proportion of unspawned eggs. Genetic pedigree studies[11] of adults returning to tributary dams in the Upper Willamette have been ongoing at Detroit Dam (North Santiam River), Foster Dam (South Santiam River), and Cougar Dam (McKenzie River) (Banks et al. 2014a). These studies provide information on the productivity of adults transported above impassable dams, and provide information for evaluating success of fish passage systems.

Additionally, Willamette salmon species face serious threats from California sea lions that prey on fish waiting to move up fish ladders at Willamette Falls. ODFW is now pursuing authorization to begin removing California sea lions preying on threatened fish to areas below Willamette Falls.

Overall, McKenzie River spring-run Chinook salmon natural origin abundance has declined to levels not seen since the time of listing (NMFS 2015). This decline has occurred despite a trap and haul program restoring access to spawning habitat in the South Fork McKenzie River above Cougar Dam. Genetic pedigree based estimates of cohort replacement rate for 2007 and 2008 brood years from hatchery adults released above the dam were both below replacement, 0.41 and 0.31, respectively (Banks et al. 2014a). Juvenile tagging studies suggest that total survival

[11] As of 2018 these studies are no longer being funded.

through the Cougar Reservoir and Dam project has been poor (Beeman et al. 2013). While the effort to restore access to spawning habitat above Cougar Dam has resulted in the natural production of juveniles and returning adults, at juvenile downstream passage and adult return current levels, there appears to be little net improvement in productivity. Overall, redd counts for the entire McKenzie River have declined over the past five years, suggesting a more systematic limiting factor. Trends for the entire population between the past three five-year periods are negative (Table 8); however, it remains unclear what drives trends in adult abundance or whether trends may improve with changes in ocean or annual environmental conditions.

Table 8. 5-year geometric mean of raw natural-origin spawner counts. This is the raw total spawner count times the fraction natural-origin spawner estimate, if available. In parentheses, 5-year geometric mean of raw total spawner counts is shown. The geometric mean was computed as the product of counts raised to the power 1 over the number of counts available (2 to 5). A minimum of 2 values were used to compute the geometric mean. Percent change between the most recent two 5-year periods is shown on the far right. (NMFS 2015)

Population	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014	% Change
Willamette Falls	(39891)	(26608)	20900 (66906)	7567 (25547)	9269 (38630)	22 (51)
Clackamas River	1307 (3961)	472 (1430)	2063 (4460)	1381 (2308)		
McKenzie River	2134 (3583)	1118 (1539)	3241 (5100)	1793 (2457)	1446 (2254)	-19 (-8)
N. Santiam River			408 (12064)	290 (4136)	852 (5963)	194 (44)
S. Santiam River			1108 (1108)	450 (883)	575 (1686)	28 (91)

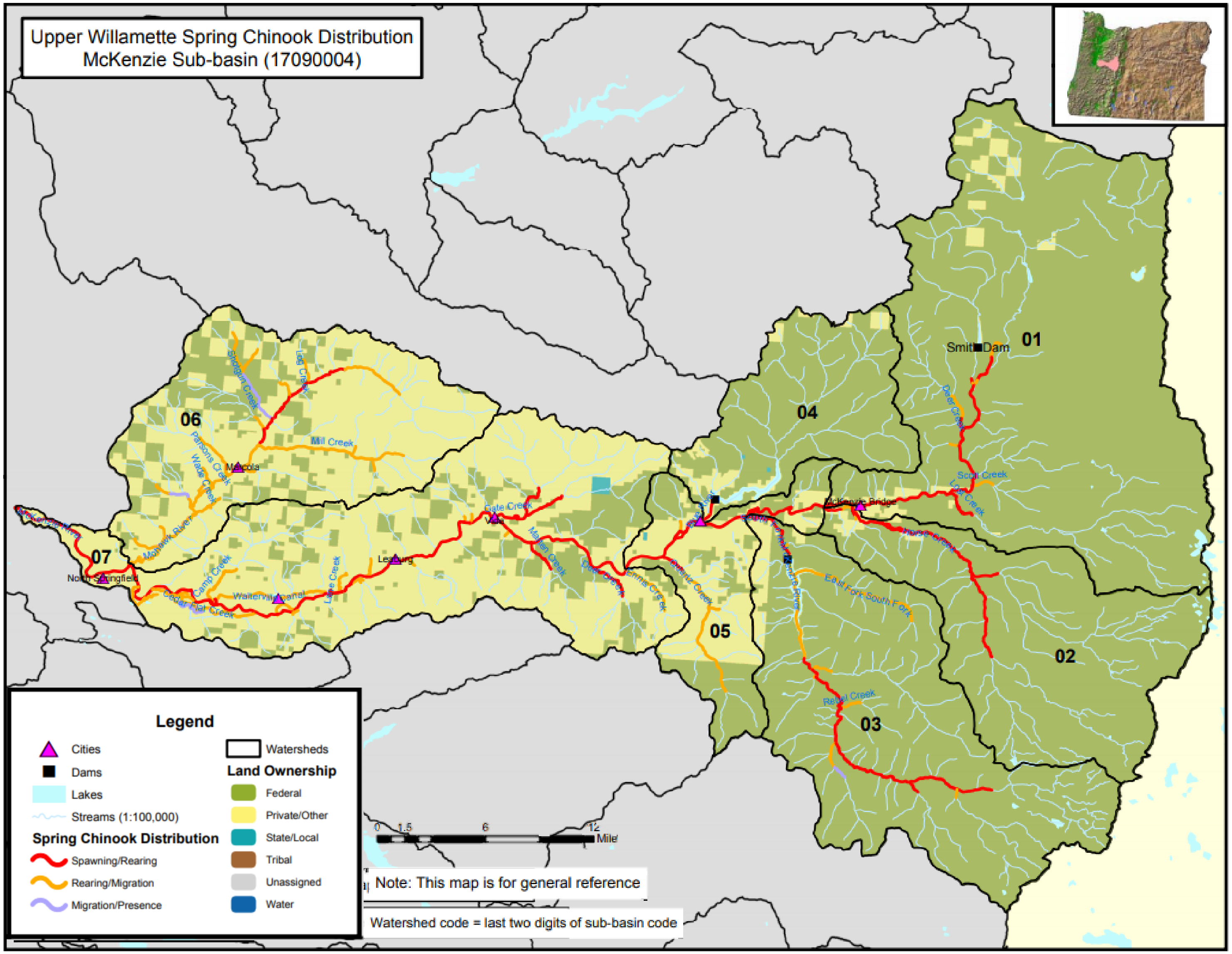

Figure 54. UWR spring Chinook (NMFS 2005).

Upstream Passage: After dam completion, the Corps trapped adult salmon at a collection facility in the tailrace and trucked salmon upstream to a release point near the reservoir head. Beginning in 1964, the Oregon Fish Commission evaluated the system in a four-year study. After the first two years, serious problems were evident. Adult spring Chinook salmon entered the permanent trap in the tailrace channel in August and September rather than as expected in June and July (Ingram and Korn 1969). Ingram and Korn observed that the discharged surface water attracted many fish through the regulating outlet. In an attempt to collect those fish, ODFW built a temporary trap into the weir at the downstream end of the regulating outlet channel. When both traps were operating, the trap in the RO channel collected virtually all fish. Ingram and Korn concluded that the temperature of water in the tailrace, which was 10°F (5.6°C) cooler than in the RO channel, resulted in the poor return of adults to Cougar Dam. The Corps judged the original fish trap a failure and last used it to collect adult spring Chinook salmon for transfer to areas above Cougar Dam in 1966. The RO trap was also abandoned shortly afterwards due to the overall low collection of adults as well as significant issues with the downstream passage system (USACE, 1970).

As discussed in Section 3.10, the Corps constructed the AFCF in order to collect adult Chinook salmon and other species at the base of Cougar Dam and haul them to upstream release sites. The Corps tags the unclipped Chinook returning to the AFCF and transports them downstream to the mainstem McKenzie River. If these fish return to the AFCF a second time, the Corps transports and releases them above Cougar Dam upstream. This management strategy avoids the transportation upstream of the dam of natural origin (e.g., genetically wild fish) that did not originate above the dam. Parentage data have shown that the majority of unmarked fish arriving prior to September are fish originating from parents released above Cougar Dam. In September, more unknown origin fish return to the AFCF and are assumed to be fish that hatched from reds below Cougar Dam (Sard, et. Al 2016a). When the AFCF does not meet the target minimum escapements[12] of 400 females and 200 natural origin males, the Corps uses hatchery fish to supplement escapement totals. The relatively few marked hatchery Chinook (clipped fish) returning to the AFCF have different destinations depending on need. These include broodstock, tribal use, outplanting above Cougar Dam, stream enrichment, and food share. Summer steelhead and resident fish captured at the AFCF are recycled back into the river.

Downstream Passage: To augment recreational trout fishery (Mamoyac and Ziller 2001), ODFW began releasing hatchery-reared juvenile Chinook into Cougar Reservoir in 1963, and

[12] Salmon escapement is the amount of a salmon population that return to their freshwater spawning habitat. Estimates of these amounts are calculated with statistical analysis using data collected during that particular run season.

then began releasing hatchery-origin adult UWR Chinook salmon above Cougar Dam in 1993 to restore inputs of marine-derived nutrients and a prey base for bull trout in the upper South Fork watershed. ODFW originally assumed that if juvenile salmon tried to leave the reservoir, passage through the turbines or regulating outlet would kill most juveniles produced by these adults. However, between 1994 and 1997, field observations provided circumstantial evidence that some juveniles survived passage (Taylor 2000). During the first year of a two-year passage study (November 1998 - March 1999), approximately 14,000 juvenile Chinook migrated through the regulating outlet and of these, approximately 1,500 to 3,900 through the turbines (Taylor 2000).

3.18.2 Species under USFWS Jurisdiction

The Corps retrieved information on ESA-listed, proposed threatened, and candidate wildlife species from USFWS Environmental Conservation Online System and the Information, Planning, and Conservation System. Table 9 provides a list of ESA-listed, proposed threatened, and candidate wildlife species found within Lane County, Oregon. USFWS has proposed critical habitat for 12 of the listed species. Three USFWS ESA listed species may occur within the vicinity of the project including northern spotted owl (Threatened), red tree vole (Candidate), and bull trout (Threatened). The remaining species listed under the ESA for Lane County, Oregon, are not found within the project area either due to habitat requirements or they are species that have been extirpated within the project area. Some species, e.g., leatherback sea turtle, loggerhead sea turtle, Olive Ridley sea turtle, marbled murrelet, Western Snowy Plover, and Short-tailed albatross are associated with coastal environments, which are outside of the project area. As the habitat within the project area is a combination of mixed coniferous forest and riparian corridor forests, the following species are not found within the project area due to inadequate habitat: Fender’s blue butterfly, Oregon silverspot butterfly, Kincaid’s lupine, Willamette daisy, Water howellia, Golden paintbrush, Nelson’s checkermallow, Bradshaw’s desert-parsley, and Streaked-horned lark. North American wolverine are not found within the project area due to a lack of suitable habitat. Yellow-billed cuckoo and Oregon spotted frog occurred within the project vicinity historically; however, for Oregon spotted frog, the only known locations are in high elevation lakes and wetlands located to the east and southeast of Cougar Reservoir in the upper Deschutes River Basin, Three Sisters Wilderness, and Gold Lake. Yellow-billed cuckoo historically were found throughout riparian areas of Oregon. The last recorded observations of this species in the project vicinity occurred in the late 1800s near Sweet Home, Oregon (part of the Santiam River Sub-basin), and near Bend, Oregon (Deschutes River Sub-basin), in 1990.

Table 9. ESA-listed Species under USFWS Jurisdiction

Common Name	Scientific Name	Federal Status	Critical Habitat	Protective Regulations
Amphibians				
Oregon spotted frog	*Rana pretiosa*	Threatened	Designated	79 FR 51657 81 FR 29335
Birds				
Short-tailed albatross	*Phoebastria (Diomedea albatrus)*	Endangered	Not Designated	65 FR 46643
Yellow-billed cuckoo	*Coccyzus americanus*	Threatened	Proposed	79 FR 71373
Western snowy (coastal) plover	*Charadrius nivosus nivosus*	Threatened	Designated	53 FR 45788 77 FR 63727
Northern spotted owl	*Strix occidentalis caurina*	Threatened	Designated	55 FR 26114 77 FR 71875
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	Designated	75 FR 3424 76 FR 61599
Streaked horned lark	*Eremophila alpestris strigata*	Threatened	Designated	78 FR 61452 78 FR 61506
Fish				
Bull trout	*Salvelinus confluentus*	Threatened	Designated	64 FR 58910 75 FR 63898
Oregon chub	*Oregonichthys crameri*	Recovery		80 FR 9125
Plants				
Bradshaw's desert-parsley	*Lomatium bradshawii*	Endangered		51 FR 38448
Nelson's checker-mallow	*Sidalcea nelsoniana*	Threatened		58 FR 8235
Golden paintbrush	*Castilleja levisecta*	Threatened		62 FR 31740
Water howellia	*Howellia aquatilis*	Threatened		59 FR 35860
Willamette daisy	*Erigeron decumbens*	Endangered	Designated	65 FR 3875 71 FR 63862
Whitebark pine	*Pinus albicaulis*	Candidate		
Kincaid's lupine	*Lupinus sulphureus* ssp *kincaidii*	Threatened	Designated	65 FR 3875 71 FR 63862
Insects				
Oregon silverspot butterfly	*Speyeria zerene hippolyta*	Threatened	Designated	45 FR 44935
Fender's blue butterfly	*Icaricia icarioides fenderi*	Endangered	Designated	65 FR 3875 71 FR 63862
Mammals				
North American wolverine	*Gulo gulo luscus*	Proposed Threatened		
Red tree vole	*Arborimus longicaudus*	Candidate		
Reptiles				

Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Designated	44 FR 17710
Loggerhead sea turtle	*Caretta caretta*	Endangered		45 FR 29054
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened		45 FR 29054

Northern spotted owl

The northern spotted owl (*Strix occidentalis caurina*), listed as threatened under ESA, occurs primarily in late seral stage conifer forest with habitat structure that meets requirements for prey, cover, and nesting. The typical habitat consists of moderate to high canopy closure with a multilayered, multispecies canopy dominated by large overstory trees greater than 30 in diameter at breast height (dbh) with the presence of large cavities and broken tops (Forsman et al. 1984).

Northern spotted owl pairs occupy the same territories year after year provided that suitable nesting habitat remains present. The nesting cycle begins in late February - early March when pairs begin to roost together. Northern spotted owls produce one to three eggs in March or April. Incubation lasts for approximately 30 days, and juvenile owls exit the nest in May or June three to five weeks after hatching. Juveniles remain near the nest and are dependent on adults for food items until August or September before becoming independent and dispersing from the nesting area (Marshall et al. 2003; Thomas et al. 1990). Although a pair will continually occupy the same territory, home range expands during winter when individuals wander extensively (Forsman et al. 1984).

Several activity centers have been identified in the study area and USFS is managing some of the area around Cougar Reservoir as northern spotted owl habitat (Forest Service, 1990). A pair of owls have a known nest located more than 1.25 miles away (Paul Bridges, USFWS, Personal communication, 2018).

Northern spotted owl habitat is classified as:

- Suitable habitat that provides for nesting, roosting, and/or foraging and dispersal;
- Dispersal-only habitat that provides for protection from avian predators and at least minimal foraging opportunities during dispersal and colonization periods; and
- Non-habitat.

The general home range of breeding northern spotted owls is estimated as a 1.2 mile circle around the nest tree and a core area defined as a 0.5 mile radius around the nest tree. An area measuring 300 meters in radius around the nest tree is known as the nest patch. At least 40% of the home range and 50% of the core area should be suitable habitat to support nesting and rearing of young (USFS 2018).

Red tree vole

The red tree vole (*Arborimus longicaudus*) is a small arboreal mammal endemic to conifer forests within western Oregon and northern California. While the species does use second growth forests for foraging and breeding, red tree voles tend to be more abundant in and prefer older forests. While they can feed on a variety of conifer needles, red tree voles tend to select Douglas fir for both foraging and nesting.

Red tree voles construct their nests of branchlets, discarded resin ducts, and other tree materials shaped into a sphere with interior tunnels. Nests grow in size as long as red tree voles actively occupy them. Litter sizes are small relative to other diminutive mammals with just three young per litter. Red tree voles can raise multiple litters at one time, and young do not disperse until 47 - 60 days old. Red tree voles have a limited home range, less than half an acre, and dispersal distance is often less than 100 yards (73 FR 63919-63926).

Bull trout

The 2008 USFWS BiOp lists three populations of bull trout in the McKenzie Sub-basin: (1) South Fork McKenzie local population above Cougar Dam; (2) Trail Bridge Reservoir local population in the upper McKenzie above Trail Bridge Dam; and (3) fluvial mainstem McKenzie local population (USFWS 2008). Overall, there is a stable or increasing population abundance trend in the South Fork local population (Figure 55). This information demonstrates a reasonable conclusion that the status of bull trout in these core areas remains unchanged from that described in USFWS Willamette Project BO.

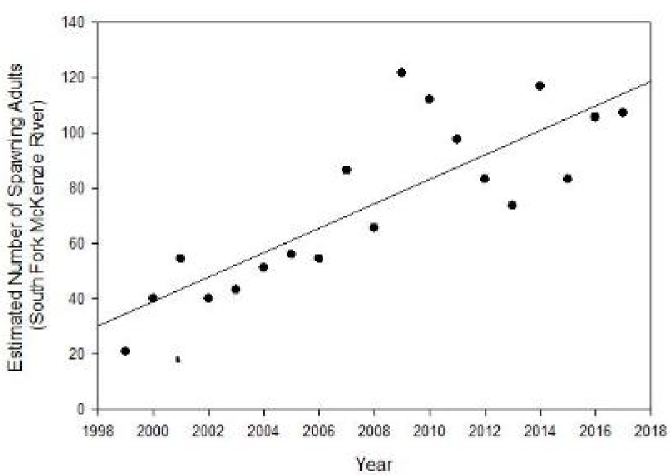

Figure 55. Estimated number of spawning bull trout adults – South Fork McKenzie River (1999-2017). Data from N. Zymonas, ODFW, personal communication, January 22, 2018.

Radio telemetry, PIT tag interrogation data, and snorkeling surveys revealed a prevailing migration pattern in which most large bull trout moved upstream from the reservoir in April -

June, returned in September - October, and occupied the reservoir through winter. Tagged bull trout initially congregated near the head of the reservoir in October and moved about the reservoir during winter. A second movement pattern consisted of fish moving upstream as far as RM 12–15 before returning to the reservoir in late summer or autumn.

3.18.3 Environmental Consequences

3.18.3.1 Alternative 1. No Action

Upper Willamette River Chinook

Under the No Action Alternative, it is unlikely that there would be significant increase of natural origin fish returning to the McKenzie. It is also possible that the core population of natural origin UWR spring Chinook in the mainstem below Cougar may continue to decline.

Northern Spotted Owl

Under the No Action Alternative, there would be no direct or indirect impacts to Northern spotted owls.

Red Tree Vole

Under the No Action Alternative, there would be no direct or indirect impacts to red tree voles

Bull trout

Under the No Action Alternative there would be no construction impacts; however, bull trout and other aquatic species would also not experience the intended benefit of increases connectivity to other populations below the dam, and the various populations of bull trout within the Basin may be at greater risk of genetic drift and lower long-term viability. Note, the population of bull trout above Cougar is the most genetically distinct and diverse; it is thought to be a “relic native” population that has managed to persist despite isolation due to the construction of Cougar Dam (Bohling, 2017).

3.18.3.2 Alternative 2. Floating Screen Structure with Trap and Haul

The construction activities associated with Alternative 2 may have moderate, short-term effects (detailed below) on UWR Chinook salmon and bull trout related to changes in flow and temperature as well as entrainment or stranding in the reservoir with long-term benefits due to the availability of downstream passage at Cougar Dam. The 2008 BiOps covers ESA consultation on the Project with NMFS and USFWS for Threatened UWR Chinook salmon and bull trout (Coastal Recovery Unit), respectively. Under the BiOp, effects determination for spring Chinook salmon and bull trout is *May Affect, Likely to Adversely Affect,* for both species and their

designated critical habitat (due to short-term impacts during implementation), but not likely to jeopardize the species or adversely modify critical habitat in the long-term. The BiOp allows for some take (defined as “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect”) of both species.

The Corps has determined that the proposed action would not affect suitable spotted owls or red tree voles, since there is a low likelihood of species occurrence in the project vicinity.

UWR spring Chinook

Alternative 2 would require a 12-month drawdown of the Cougar Reservoir to elevation 1,450 ft for construction of the project during which time the Corps would be unable to operate the WTCT to manage downstream temperatures and TDG. Through coordination with NMFS, USFWS, and ODFW, the Corps identified water quality effects to likely adversely affect ESA-listed UWR Chinook salmon late summer/early fall migration and spawning activities on the South Fork McKenzie due to the lack of temperature control during the proposed drawdown. Cooler water temperatures than normal in late spring and early summer can delay upstream migration of UWR Chinook salmon. For fall spawning species like Chinook salmon, warmer fall temperatures (released from Cougar Dam after the reservoir has warmed over the summer) can delay spawning. Warmer fall temperatures can also exceed the thermal tolerance for incubating eggs, reducing viability. Eggs exposed to temperatures of 60°F or greater would likely not survive. If temperatures do not exceed 60°F, accelerated egg development may result in early emergence of juvenile fish from their eggs. Assuming that these fish are well adapted to the environment in which they evolved, such changes in emergence timing disadvantages the fish. Ecological issues such as the abundance of predator and prey species changes over time. For example, an early-emerging Chinook salmon alevin may have little to eat. Such thermal effects may reduce the potential utility of habitat downstream from the dams and reduce the viability of the affected populations. (NMFS 2008)

To determine how a lack of temperature and TDG control would affect UWR spring Chinook during the drawdown to elevation 1,450 ft under the proposed action, the Corps performed further analysis of water quality impacts, specifically temperature and TDG impacts. Sub-section 3.14 summarizes the anticipated effects of a deep drawdown on temperature and TDG. It also includes an assessment of the anticipated water quality effects of operations of the proposed project. As described in Sub-section 3.14, the Corps used the following three scenarios to assess the alternatives impacts on water quality on UWR spring Chinook:

- "*Baseline*" represents the existing conditions (Alternative 1; No Action);
- "*FSS*" represents operation of the proposed FSS (post construction operations of Alternative 2); and

- "*1,450Pool*" represents a constant pool elevation of 1,450 ft (construction conditions for Alternative 2).

Based on CE-QUAL-W2 temperature modeling of Cougar Reservoir (provided in Sub-section 3.14), The Corps has made the following determinations:

- Under the proposed action, temperatures in late-spring and early summer are similar to the No Action Alternative and are not expected to delay upstream migration of UWR Chinook salmon (Figure 47 and Figure 56);
- Under the proposed action, it is unlikely that temperatures would go above 60°F, when eggs experience direct mortality after prolonged exposure (Figure 47); and
- Under the proposed action, UWR spring Chinook may experience early emergence by an estimate of 18- 22 days (Figure 57 and Figure 58).

Figure 56 shows the percent of time exceeding the temperature criteria for each life stage/period as measured below Cougar Dam. The Corps derived the minimum and maximum values (shown as error bars) from the range of the calendar-year simulations (2001, 2004, 2006, and 2008). Life stages span the following timeframes as follows: Migration (May 1 - July 15), Holding (May 1 - Sep 15), Rearing (May 1 - Sep 15), Spawning (Sep 1 - Oct 15), and Incubation (Sep 1 - Dec 31). Notable differences between construction conditions for Alternative 2 (1450Pool) and Alternative 1 (No Action; Baseline) are less time exceeding 60°F during the holding period and potentially more time spent exceeding 60°F during the fall spawning period.

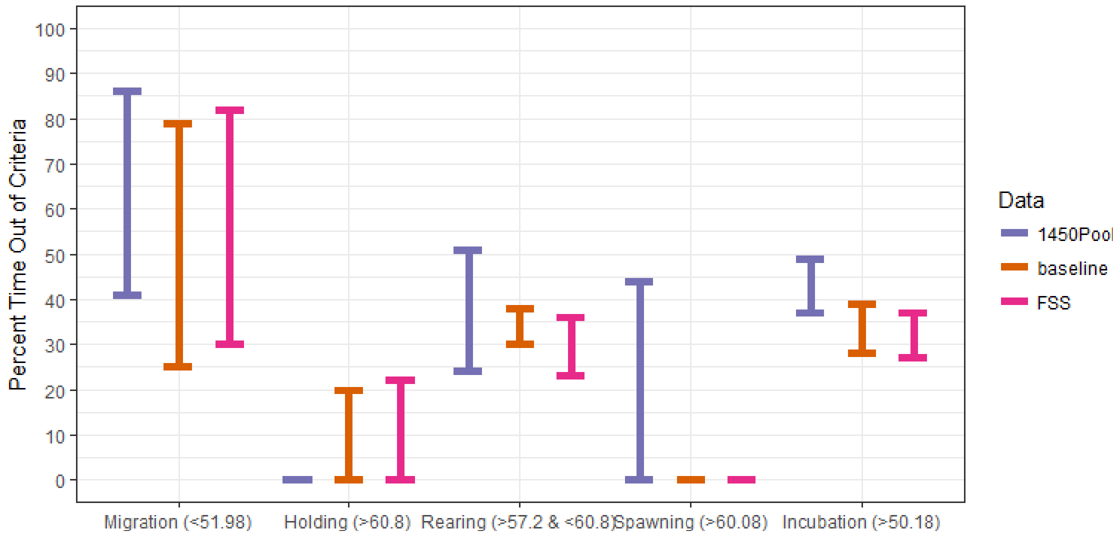

Figure 56. Percent of time exceeding the temperature criteria for each life stage/period as measured below Cougar Dam.

Figure 57 shows emergence timing from three assumed spawning days (x-axis), for Alternative 1 (Baseline), construction conditions for Alternative 2 (1450Pool), and post construction operations of Alternative 2 (FSS scenario). Emergence timing ranges were derived from model simulations of the maximum, minimum, and mean from 2001, 2004, 2006, and 2008 calendar year scenarios and are represented by error bars and dots respectively in Figure 57. For reference, Figure 57 compares these ranges to emergence timing derived from water temperature measurements above (USGS 14159200 labeled "MsrdAbvCGR") and below (USGS 14162500 at Vida labeled "MsrdAtVida") Cougar Dam since the WTCT has been operational at Cougar Dam [2006-2017].

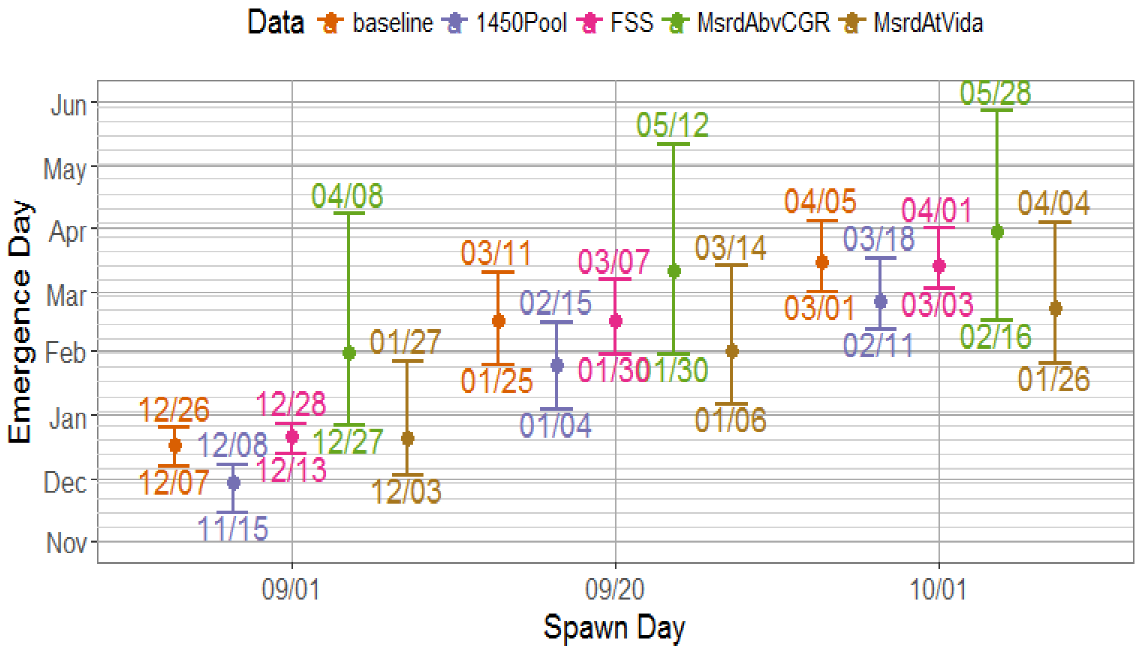

Figure 57. Calculated emergence timing based on a degree-day calculation beginning on the spawning day and what day 1750 degree (F)–day thermal units is met.

Simulated differences in emergence timing in relation to Alternative 1 (Baseline), construction conditions for Alternative 2 (1450Pool) and post construction operations of Alternative 2 (FSS scenario) from three assumed spawning dates is shown in Figure 58. Error bars represent maximum and minimum emergence timing delays over the range of the simulation calendar year scenarios (2001, 2004, 2006, and 2008). Based on this analysis, we anticipate that UWR spring Chinook fry would emerge 18-22 days earlier during the construction period for Alternative 2 than they would under the current operations and temperatures below Cougar dam (Alternative 1; Baseline). For the post-construction operations of Alternative 2 (FSS scenario), there were small changes in the simulated emergence which were six days later to four days earlier than Alternative 1 (Baseline).

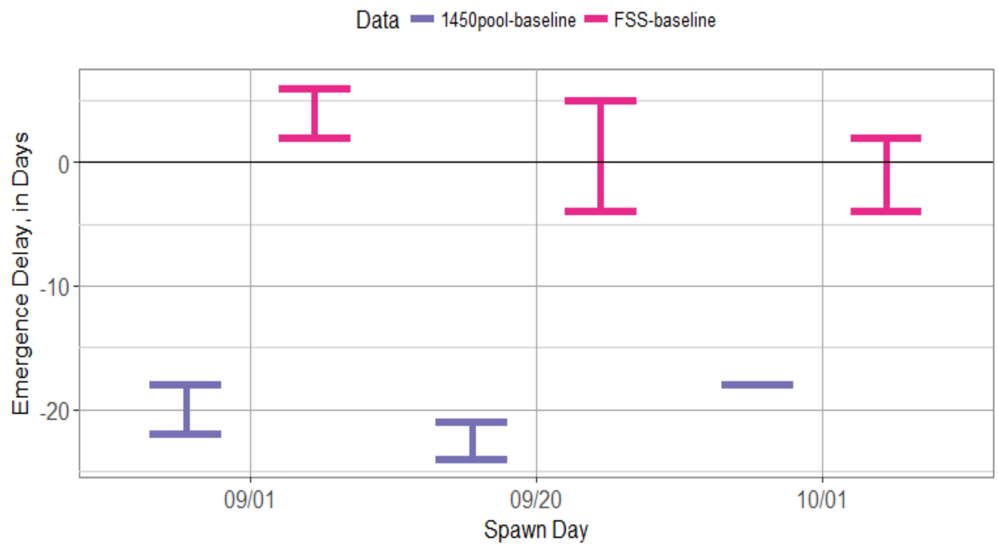

Figure 58. Differences between the emergence timing from 1,450pool and FSS scenarios in relation to baseline scenarios for three assumed spawning days.

Given that the mean emergence timing during the construction of Alternative 2 would be within the emergence timing range of values for reaches above and below the project reservoir (Figure 57), the Corps has determined that temperature has a minor effect to Chinook salmon.

Under Alternative 2, during the drawdown, the Corps may not be able to meet minimum BiOp flows (300 cfs) in July - September during the FSS construction period (Figure 33). The Corps anticipates that base flow may be near 200 cfs. The principle effect would be a reduction in available habitat in the mainstem South Fork McKenzie. This amount of habitat would be similar to what would be available without the presence of the dam, since the project would be passing inflow. The reduced release rates will be compensated for by using the diversion tunnel (the deepest outlet at the dam), which will access the coolest water in the lake. As releases will be lower than BiOp minimum flows during the late summer, heat exchange between the water, river bedrock, and atmosphere will be more efficient. This will lead to the river reaching equilibrium with the atmosphere sooner downstream than with BiOp minimum flows. Thus, more natural temperatures would be achieved for a greater longitudinal distance moving downstream of the dam when compared to BiOp flow values.

The drawdown to elevation 1,450 ft would also increase risks of stranding in isolated pools. The Corps, in coordination with ODFW, would implement fish salvage plans similar to those used during the 2016 emergency trash rack repair (Appendix E). During the trash rack repair, fish salvage biologists neither salvaged nor observed any stranded UWR Chinook salmon (USACE 2016b). At elevation 1,450 ft, the pool would not expose many pools which were observed during the early phases of the WTCT construction. Therefore, it is unlikely that construction activities would strand very many (if any) UWR Chinook salmon.

Low passage rates due to the depth of the outlet beneath the surface of the reservoir, relatively high passage mortality rates for parr and smolts, and relatively high survival for the few fry that end up passing characterize passage of UWR Chinook salmon during the drawdown to 1,450 ft. The passage of UWR Chinook salmon during the drawdown to elevation 1,450 ft would likely be analogous to conditions during construction of the WTCT, specifically 2003-2005 (see Zymonas 2011).

The long-term effect of the successful implementation and operation of the FSS would be to increase the abundance of wild UWR Chinook salmon and reestablish a sustainable population above the dam. It would also aid the ESU by increasing spatial distribution and genetic diversity (NMFS 2008).

Northern Spotted Owl

Early in the process, the Corps coordinated with USFWS to determine if/how the project could affect Northern spotted owls and their critical habitat. The Corps has determined that the proposed action would not affect suitable spotted owl habitat, as there is a low likelihood of occurrence of the northern spotted owl in the project vicinity given that the closest known nest is more than 1.25 miles away. Therefore, the Corps has determined no effect for the northern spotted owl. No work would occur in northern spotted owl designated critical habitat and the project would have no effect on critical habitat.

Red Tree Vole

The Corps determined that proposed action would not affect suitable red tree vole habitat as there is a low likelihood of occurrence of the red tree vole in the project vicinity given the impact of the 2018 Terwilliger Fire on suitable habitat in the project area. Therefore, the Corps has determined no effect for the red tree vole. No work would occur in red tree vole designated critical habitat and the project would have no effect on critical habitat.

Bull trout

During the FSS construction period, the Corps expects reduced pool elevations and increased releases from Cougar Dam to increase passage rates for both juvenile salmon and bull trout at Cougar Dam (Beeman 2012, and Zymonas 2011). This is especially true during RO operations below elevation 1,572 ft. Although the RO is a safer route for juvenile salmonids, it likely is a hazardous route for adult sized bull trout, which risk physical injury and mortality from strike. Under Alternative 2, the Corps would drawdown the Cougar Reservoir pool to elevation 1450 ft using the diversion tunnel. The diversion tunnel is at elevation 1290 ft. The Corps considers entrainment a relatively low risk once the construction pool of elevation 1450 ft is reached, as bull trout are unlikely to dive 160 ft to the diversion tunnel. The depth to the diversion tunnel under a 1450 ft drawdown is larger in comparison to the original WTCT

construction, since this construction pool will not have as low an elevation as it did from 2002-2004 for the WTCT construction. The highest risk of entrainment is likely during the early stages of the drawdown as the pool elevation nears the elevation of the ROs and penstock. Fortunately, unlike the situation during the WTCT construction, continued operations of the adult facility will be able to pass entrained fish back above the dam, reducing the population sink effect.

Drawdowns below normal operations (1,516 ft) also could pose greater risk for fish stranding in isolated pools. Monitors observed but did not quantify stranding mortality of adult bull trout during the 2002 drawdown for the WTCT construction. However, for Alternative 2, the Corps would only drawdown the pool to elevation 1,450 ft, which is above the 2002 drawdown level and many of the pools that pose a stranding risk. Additionally, many of these pools were modified during the WTCT construction period (2002-2005) to connect them to the river (Zymonas 2011), further reducing the risk of stranding for bull trout and other fish. Risk of stranding for Alternative 2 is likely equivalent to the 2016 emergency trash rack repair for which the Corps drew down the pool to elevation 1,450 ft. During the emergency trash rack repair, biologists from ODFW Bull Trout Monitoring Crew were onsite and indicated through radio telemetry equipment that no tagged bull trout were present in the residual pool directly in front of the WTCT. ODFW crew described the nearest detection as located in the reservoir, which is outside of the cul-de-sac area and safe from any dewatering or stranding (USACE 2016b). Under Alternative 2, the Corps, in coordination with ODFW, would implement fish salvage plans similar to those used during the 2016 emergency trash rack repair (Appendix E). During the trash rack repair, fish salvage biologists neither salvaged nor observed any stranded bull trout (USACE 2016b). Therefore, it is unlikely that construction activities would strand very many (if any) bull trout.

Reservoir temperature impacts on adult and sub-adult bull trout were also of concern, as reservoir temperatures are expected to be higher in the fall during the proposed construction drawdown compared to the Baseline/No Action Alternative (see Section 3.11.4). According to Selong et al., 2001, survival of age-0 bull trout was at least 98% up to 18°C, with the predicted ultimate upper incipient lethal temperature for these trout at 20.9°C. Based on temperature modeling results (Figure 45 - Figure 48), there would be reservoir areas in the water column during the construction drawdown at or below 18°C available to bull trout. Age -0 bull trout are likely the more sensitive to temperature than adult bull trout; therefore this is a conservative survival estimate for the bull trout population in Cougar Reservoir. Therefore, the Corps does not find reservoir temperatures during the proposed construction drawdown to have a significant impact on bull trout.

By increasing the connectivity and population's genetic diversity, successful implementation of the proposed action would ultimately benefit not only the bull trout population above Cougar, but also all Upper Willamette bull trout populations. There would also be a reduction in mortality associated with downstream passage of all bull trout life stages. This would ultimately decrease the risk of extinction and improve the species resiliency.

3.19 Fisheries and Hatcheries

Fisheries

Fish of the McKenzie Basin are important to many commercial and sport fisheries, principally those for Chinook salmon, steelhead, and resident trout. For Chinook salmon (and other fisheries that catch UWR Chinook salmon as bycatch), state, federal, and international processes manage the fisheries. For example, as part of the North of Falcon process,[13] a body of federal, state and tribal representatives hold a series of public and committee meetings to discuss, analyze, and negotiate the fisheries for salmon and steelhead stocks north of Cape Falcon Oregon for the year. This process includes determining how impacts to UWR Chinook would be shared amongst the ocean, inner coastal, and freshwater fisheries, including the lower Columbia River. Most season dates, limits, and even approved fishing methods and gear are determined in these meetings, and all are based on the run-size prediction for various listed stocks. The managers use this prediction to spread an allowed impact for each listed stock across all various sport and commercial fisheries. During open season for the fisheries, catch numbers are monitored and the fishery is adaptively managed to ensure allowed impacts are not exceeded. The numbers of natural origin and hatchery origin adults returning each year directly affect the seasons. All fisheries (tribal, recreational, and commercial) are very important locally and regionally as well as economically and culturally.

The McKenzie River is also widely recognized as having an excellent recreational trout fishery for both the hatchery and wild trout. As management practices of having sections of the lower McKenzie receive frequent hatchery plantings to enhance harvest and angling opportunities continue, some wild fish advocates would like to see reductions or cessation of hatchery trout plants in order to try and reestablish the wild trout populations.

Hatcheries

Congress authorized the construction, operation, and maintenance of hatcheries in cooperation with state and federal fisheries agencies to provide mitigation, in part, for habitat lost or made inaccessible by the construction of WVS dams. There are also hatchery programs maintained by the Oregon State to enhance sport fisheries and harvest opportunities.

[13] https://wdfw.wa.gov/fishing/northfalcon/faq.html

The McKenzie Hatchery is located along the McKenzie River approximately 22 miles east of Springfield, Oregon, and comprises 16 acres. This program is managed for two purposes, which are outlined in the 2016 draft Hatchery Genetic Management Plan (HGMP):

1. To provide ESA conservation benefits, consistent with survival and recovery of the ESU; and
2. To mitigate habitat lost or made inaccessible by the construction and operation of Blue River and Cougar Dams, which would provide adult returns to help meet harvest objectives for the McKenzie River, lower Basin, and ocean fisheries.

Since McKenzie Hatchery supports conservation and reintroduction of natural origin fish, it is managed as an integrated broodstock program for UWR Chinook salmon, with regular incorporation of natural origin adults from the McKenzie population (USACE/ODFW 2016). Currently, the hatchery releases 604,750 marked juvenile Chinook per year, with Corps mitigation funding 360,000 of those released. In spite of recent efforts to reduce the effects of the McKenzie Hatchery Program, the McKenzie Hatcher Program continues to miss important management goals such as reducing the proportion of hatchery origin spawner (PHOS) levels below 10% (Sharpe, 2017). It should be noted, however, that the effectiveness of the most recent actions to reduce PHOS will not be known until the adult returns are monitored for several years after 2019.

In addition to the UWR Spring Chinook Hatchery Program, the McKenzie Hatchery also releases summer steelhead and legal-sized rainbow trout (the Corps only funds the trout program). The release of these trout are associated with mitigation for the construction of the Willamette Valley Project. The summer steelhead hatchery program releases 108,000 yearling smolts per year in the McKenzie, and the rainbow trout hatchery program releases total 50,000 pounds in the McKenzie River (15,000 and 25,000 below and above Leaburg Dam, respectively, and 10,000 in Leaburg Lake). These release numbers do not include fish released above Blue River, Carmen-Smith, and Trailbridge Dams in the McKenzie Basin.

3.19.1 Environmental Consequences

3.19.1.1 Alternative 1. No Action

Under the No Action Alternative, it is unlikely that there would be any significant increases in natural UWR Chinook salmon in the McKenzie, and the population below the dams may continue to decrease. These impacts could affect a broad range of fisheries targeting UWR Chinook salmon or fisheries that may encounter UWR Chinook salmon as bycatch since reduced numbers of natural origin fish would also reduce the allowed impact fisheries may have. The result could be reduced harvest opportunities for hatchery and non-listed stocks, as well as fisheries that target other species but may encounter UWR Chinook salmon as bycatch. It is

possible that under the No Action Alternative there would be further reductions in fishing opportunities. If the abundance of natural UWR Chinook salmon spawners remains the same or decreases, then McKenzie PHOS levels (a ratio of natural origin to hatchery origin fish), would likely remain > 10%. This may necessitate additional changes to hatchery infrastructure, fish production, and/or operations, including the trapping and removal of hatchery Chinook from the Leaburg ladder, in order to achieve the ≤ 10% recovery plan goal.

3.19.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

The construction activities associated with Alternative 2 may have moderate, short term effects on individual fish above and below Cougar dam as discussed in Section 3.17.1.2, which may have negligible to minor impacts of fisheries because the impacts would be short term in duration. Successful implementation of Alternative 2 would increase natural origin fish numbers in the McKenzie River, and the greater abundance of wild fish would be able to sustain greater impacts from fisheries. In theory, these effects should increase opportunities for fisheries; however, since many fisheries harvest mixed stocks (e.g., fish from different basins/Distinct Population Segments) it is likely that even though harvest opportunities in the McKenzie may increase, regionally, the fisheries would not significantly change unless there is a broader recovery of ESA listed stocks from additional basins. This greater abundance of wild fish due to the increased productivity above Cougar would also make it easier to achieve PHOS management goals for the McKenzie Basin. This would be especially true once the population above the dam meets the minimum escapement goals and no longer requires hatchery outplants supplementation.

Under Alternative 2, there are no anticipated impacts to the hatchery or its operations. Once completed, the project implementation would likely require the continued use of hatchery supplementation to support the reintroduction and reestablishment of natural origin Chinook above Cougar Dam. With the improved fish passage, the Corps expects reductions in the production for hatchery fish mitigation in the McKenzie commensurate with access to the habitat above Cougar Dam. This does not preclude the continuance of the McKenzie Chinook and rainbow trout hatchery programs for purposes other than mitigation for Cougar Dam.

3.20 WATER SUPPLY

The McKenzie River has been extensively developed to supply water for agricultural, municipal, and industrial land uses. There are no consumptive water diversions upstream of Vida (Hubbard et al. 1996). The largest diversions from the McKenzie River are associated with hydropower developments. However, almost all water diverted for hydropower use and, roughly, half of the water diverted for other uses, returns to the river downstream from the point of diversion. These withdrawals and returns decrease and increase the flow in the

McKenzie by approximately 50%. Flows in the river reaches between the point of diversion (e.g., the Leaburg and Walterville Canals) and the point of return (e.g., Leaburg and Walterville powerhouse tailraces) are at times substantially reduced.

The Oregon Water Resource Department (OWRD) has issued permits for surface water withdrawals totaling 11,994 cfs from the McKenzie River, which includes domestic water supplies to the city of Eugene, Oregon, through a diversion, located at Hayden Bridge (maximum withdrawal rate of 300 cfs). This is the maximum allowable diversion right, and actual diversions are much lower at any particular time.

OWRD water availability process (OAR 690-400-011) has determined that natural flow is available for out-of-stream use in all months from the McKenzie River at the confluence with the Willamette River (OWRD 2008). However, the Willamette Basin Program Classifications (OAR 690-502-0110) require that new surface water users in the Sub-basin obtain water service contracts from the United States Bureau of Reclamation (USBR) (i.e., for use of water stored in Willamette Project reservoirs) for uses that include the summer months (e.g., irrigation). USBR has issued irrigation contracts for 1,772 acre-ft of water from Cougar and Blue River Reservoirs (USBR 2017).

3.20.1 Environmental Consequences

3.20.1.1 Alternative 1. No Action

The No Action Alternative would have no direct, indirect, or cumulative effects on water supply.

3.20.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

The reduced flows associated with the drawdown under the proposed action would not affect water supply, as there would be sufficient remaining flows to meet water supply needs (K. Morgenstern, EWEB, personal communication, October 17, 2018). The Corps anticipates no other direct, indirect, or cumulative effects on water supply under Alternative 2.

3.21 Hydropower

The Willamette Basin contains several federal and non-federal hydropower power-generating facilities that agencies utilize to generate electrical energy for local and regional consumption. BPA markets energy generated by the Corps' Willamette projects to help meet local and regional energy demand within the Federal Columbia River Power System. Any change in one reservoir’s operations may affect other projects in the Valley and system power production.

There are eight Corps multiple-purpose projects throughout the Willamette Basin that contain power-generating facilities, three of which are reregulation dams. Eugene Water and Electric Board (EWEB) owns and operates two run-of-river hydroelectric projects on the McKenzie River: Carmen-Smith and Leaburg-Walterville (Figure 1). EWEB's Carmen-Smith project is located close to the origination of the McKenzie River at Clear Lake; its operation is independent of system power generation. Downstream of the Corps' Cougar and Blue Lake projects, EWEB diverts McKenzie River flows to the Leaburg Power Canal and the Walterville Power Canal for hydropower generation at the Leaburg and Walterville generation facilities, and then returns these flows to the river.

3.21.1 Environmental Consequences

In this study, USACE and BPA jointly estimated impacts to hydropower. They simulated the reservoir operations at Willamette Valley hydropower generation projects under the No Action Alternative and under the proposed action, and calculated the expected value of hydropower production during the construction period for both Alternatives. A full report on this analysis can be found in Appendix B and is incorporated here by reference.

The Corps used the HEC-ResSim computer model to simulate daily reservoir operations in the Willamette Basin under various hydrologic conditions. The No Action Alternative simulation represents current operational conditions for a 73-year period of record (1935-2008). In this simulation, all reservoirs follow regulation rules consistent with current objectives and practices including flood risk management, biological support, recreation, and hydropower production. The proposed action simulation represents operational conditions during construction of the FSS where Cougar Reservoir operates to maintain a pool elevation of 1,450 ft while still following regulation rules for outflow. All other Willamette Valley reservoirs maintain rules from the No Action Alternative.

To estimate the value of hydro generation at federal projects, BPA used the reservoir operation results from ResSim with the HYDSIM model to determine the hydro-system generation at each of the eight federal projects. They HYDSIM analysis produces the amount of power generated by each power project for each month in the 73-year period of record, and the average monthly generation is also calculated. BPA estimated market prices by the AURORA model, which uses electricity demand, fossil fuel markets, generation capacity, and emissions to determine hourly clearing prices for electric power. BPA calculated monthly prices from the hourly price data by taking a weighted average using historical generation information. Finally, the Corps applied the monthly prices to the average monthly energy generated at each project, and took the sum to arrive at the average annual value of hydropower.

To estimate the value of hydro generation at EWEB's projects, the Corps used the ResSim regulated flows at project locations along with project characteristics to estimate the average monthly generation at each project. For each project, flows available for hydropower production are calculated using minimum bypass requirements and hydraulic capacity. The Corps applied energy conversion factors to available flow to find the average monthly generation. The Corps applied monthly energy prices used in the analysis of federal hydropower projects (described above) to the average monthly generation values to estimate the annual value of hydropower.

3.21.1.1 Alternative 1. No Action

The No Action Alternative would have no direct, indirect, or cumulative effects on hydropower. Under the No Action Alternative, it is assumed that all federal hydro-regulation projects, including Cougar Dam and Reservoir, are operated in accordance with requirements described in Water Control Manuals and other process and procedures documents including the Willamette Project Biological Opinion (2008). Table 10 shows the estimated monthly generation and associated economic values. The average annual value of hydropower generation at the eight federal hydropower projects for the No Action Alternative is $36.82 million.

Power generation at EWEB's projects are dependent upon McKenzie River flow volumes. The Corps did not analyze the value of power generation from Carmen-Smith as it is independent from system power operations and does not change between Alternatives. The Corps assumed Leaburg-Walterville operates year round and generates power up to its hydraulic capacity as river flows allow. The value of hydropower generation at EWEB's impacted hydropower projects is $4.2 million.

The total expected value of hydropower generation for the No Action Alternative during the one-year construction period is $41.02 million.

3.21.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Under Alternative 2, moderate effects to hydropower as power generation will be limited during construction. A sustained drawdown to elevation 1,450 ft would keep Cougar's reservoir pool elevation below the elevation of the power plant inlet so that power generation at Cougar may occur only during flood events that temporarily result in the reservoir pool rising above the minimum power pool elevation of 1,516 ft.

Cougar operations during the construction period would also have minor impacts on other Willamette Valley hydro projects. Reduced outflows from Cougar during the summer months during the drawdown would likely affect the generation capability of EWEB's run-of-river

hydropower projects downstream of Cougar at Leaburg and Walterville as well as other Willamette projects that must increase outflows to meet BiOp flow objectives at Salem. Table 11 shows the estimated average monthly generation and associated economic values for the proposed action. The average annual value of hydropower generation at the eight federal hydropower and two EWEB projects is $34.89 million and $3.9 million, respectively. The combined value of hydropower that would be generated during the one-year construction is $38.79 million.

The Corps quantified the impact of the proposed action by calculating the difference of Alternative 2 from Alternative 1 – the Base Case (Table 12). The value of the energy lost under the proposed action is $1.93 million. The loss of hydropower would not affect consumers downstream.

Table 10. Estimated Annual Hydropower Value for Alternative 1

Alternative #1 Base Case	Octo	Nove	Dece	Janu	Febr	Marc	April	May	June	July	Augu	Sept	TOTA
Generation in average megawatts (aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)
Detroit	45.3	67.8	64.2	64.5	51.1	43.0	32.3	28.2	21.8	17.2	16.9	31.2	40.2
Big Cliff	12.0	16.0	14.6	14.6	11.1	9.8	10.2	12.8	10.6	7.3	5.9	9.7	11.2
Cougar	14.2	5.1	2.0	2.2	5.9	10.5	14.1	18.1	16.2	12.8	14.1	12.1	10.6
Green Peter	15.9	31.5	54.6	48.4	25.9	28.9	33.0	30.9	24.9	15.5	14.2	22.0	28.8
Foster	10.5	15.4	19.4	18.2	14.9	16.3	18.1	15.5	13.6	8.0	6.8	10.6	13.9
Hills Creek	19.4	24.2	21.2	22.3	12.6	12.8	18.3	23.9	20.3	13.5	15.7	16.7	18.4
Lookout Point	43.9	59.9	47.0	48.1	29.3	27.2	35.2	53.5	45.4	27.0	29.7	35.9	40.2
Dexter	11.1	14.0	12.6	13.1	7.4	6.7	8.3	11.2	9.8	6.3	7.0	8.9	9.7
Total Generation (aMW)	**172.3**	**233.9**	**235.6**	**231.4**	**158.2**	**155.2**	**169.5**	**194.1**	**162.6**	**107.6**	**110.3**	**147.1**	**173.0**
Hours in Month **(hours)**	744	719	744	744	672	745	720	744	720	744	744	720	8760
Power Project **(aMW)**	105.1	159.2	165.8	161.0	106.3	99.1	100.5	112.6	92.1	59.7	60.8	89.1	109.2
Power Project **($ MIL)**	**$2.03**	**$3.02**	**$3.68**	**$3.45**	**$2.03**	**$1.74**	**$1.41**	**$1.41**	**$1.23**	**$1.08**	**$1.28**	**$1.79**	**$24.16**
Flat **(aMW)**	67.2	74.7	69.8	70.4	51.9	56.1	69.0	81.5	70.5	47.9	49.5	58.0	63.8
Flat **($ MIL)**	**$1.21**	**$1.36**	**$1.47**	**$1.39**	**$0.93**	**$0.93**	**$0.93**	**$0.88**	**$0.76**	**$0.78**	**$0.95**	**$1.06**	**$12.66**
Total Willamette Hydropower Annual Value of Alt#1 ($ Mil)												$36.82	

Table 11. Estimated Annual Hydropower Value for Alternative 2

Alterative #2 CGR Drawdown to El 1450'	Octo	Nove	Dece	Janua	Febru	Marc	April	May	June	July	Augu	Sept	TOTA
Generation	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)	(aMW)
Detroit	45.4	67.8	64.3	64.5	51.5	43.1	32.5	28.3	21.8	17.2	16.9	31.2	40.3
Big Cliff	12.0	16.0	14.7	14.6	11.2	9.8	10.2	12.8	10.6	7.3	5.9	9.7	11.2
Cougar	**0.0**	**0.0**	**0.5**	**0.7**	**0.2**	**0.0**	0.0	**0.0**	**0.0**	**0.0**	0.0	**0.0**	0.1
Green Peter	15.9	31.5	54.6	48.5	25.9	28.9	33.0	30.9	24.9	15.5	14.2	22.0	28.8
Foster	10.5	15.5	19.5	18.2	14.9	16.3	18.2	15.5	13.6	8.0	6.8	10.6	14.0
Hills Creek	18.2	22.1	21.2	22.3	12.6	12.8	18.0	23.7	20.5	14.5	17.4	16.3	18.3
Lookout Point	41.9	57.3	47.0	48.1	29.6	27.1	34.7	53.1	45.7	28.0	31.2	38.3	40.2
Dexter	10.7	13.7	12.5	13.1	7.5	6.7	8.2	11.1	9.9	6.5	7.4	9.5	9.7
Total Generation (aMW)	154.6	223.9	234.1	230.0	153.4	144.9	154.8	175.4	147.0	97.0	99.7	137.7	162.8
Hours in Month (hours)	744	719	744	744	672	745	720	744	720	744	744	720	8760
Power Project (aMW)	103.2	156.6	165.8	161.1	107.0	99.1	100.2	112.3	92.4	60.7	62.3	91.5	109.4
Power Project ($ MIL)	$1.99	$2.97	$3.68	$3.45	$2.05	$1.74	$1.41	$1.40	$1.24	$1.10	$1.31	$1.84	$24.18
Flat (aMW)	51.4	67.3	68.3	68.9	46.4	45.7	54.6	63.1	54.6	36.3	37.5	46.2	53.4
Flat ($ MIL)	$0.92	$1.23	$1.44	$1.36	$0.83	$0.76	$0.73	$0.69	$0.59	$0.59	$0.72	$0.85	$10.71
Total Willamette Hydropower Annual Value of CGR Drawdown to El 1450 ($ Mil)												$34.89	

Table 12. SUMMARY of Hydropower Benefits (losses) under Alternative #2 system operation scenarios.

ALTERNATIVE	Energy[1] & Capacity[2]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Alternative #1 Base Case	Energy	1,515.5	$36,817	---	---	---
	Capacity	102.8	$9	---	---	
Alternative #2 CGR Drawdown to Elev. 1450'	Energy	1,425.7	$34,888	-91.6	($1,928.6)	($1,928.6)
	Capacity	102.8	$9	0.0	$0.0	

1. Average annual generation (Energy) - [GWh]

2. Average annual capacity (monthly weighted) – (MW)

The McKenzie Highway Oregon State Route 126 (SR 126) (formerly U.S. 126) which traverses Lane County from Florence through Eugene/Springfield to north of McKenzie Bridge, connecting with U.S. 20, is the main highway serving the McKenzie Sub-basin. Forest roads link SR 126 to Cougar Reservoir. Aufderheide Drive (Forest Service Road 19), the southern segment of the West Cascades National Scenic Byway, parallels the South and North Forks of McKenzie River, forming a loop drive to Oak Ridge where it connects with SR 58. This stretch is a two-lane, paved road located along most of the South Fork.

ODOT classifies the SR 126 as a Group 1 Highway. The largest size trucks that can transport along Highway 126 are truck tractors and stinger-steered pole trailers (log trucks) with a maximum length of 75'; if using a truck tractor with semitrailer, the trailer can be up to 53' long. ODOT makes exceptions with an oversize vehicle permit on a case-by-case basis. The 2017 Annual Average Daily Traffic (AADT) counts for SR 126 at the Cougar Dam Road (milepost 45.37) is 3000 (ODOT 2017). AADT does not represent peak traffic counts. The Corps expects that traffic volumes would increase seasonally, during weekends and holidays when people are more likely to travel.

3.22.1 Environmental Consequences

3.22.1.1 Alternative 1. No Action

The No Action Alternative would have no direct, indirect, or cumulative effects on traffic/circulation.

3.22.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Under Alternative 2, construction traffic traveling into and out of the Cougar site should have a minor, short-term impact to other traffic using Aufderheide Drive. Traffic would be heavier during the drawdown work. The Corps does not anticipate nighttime work, but it remains possible. During the drawdown summer when construction is at its peak, the Corps estimates that an average of one semitruck of material or equipment per hour would need to access the WTCT site for up to 16 hours per day. That average would continue until approximately late December of the first year of construction. Approximately 10-30 other construction-related vehicles per day may need to access and leave the Cougar Temperature Control Tower Site and the Slide Creek site. A dozen or so oversize (permit required) loads are likely. The Corps expects any potential delays to be short-term and temporary. Lane closures, barriers, flaggers, or construction signs may be required. However, if traffic control is necessary, the Corps may deploy flaggers to halt traffic temporarily to facilitate safe entrance and/or exit of

heavy equipment and vehicles at the site. Construction traffic and haul roads would be in compliance with the Corps of Engineers safety manual, Engineer Manual 385-1-1[14]. This manual specifies use of the “Manual of Uniform Traffic Control Devices” for highway construction signage. The contractor’s traffic safety plan would address construction traffic entry and exit points onto public roads and traffic control into the site.

The Corps does not expect fish transport to impact traffic in the project area. Once the Corps commissions the FSS and commences the associated truck and haul operations, transport trucks or AVs would be transporting fish multiple times a day, seven days per week from January 1 - June 30 and September 1 - December 31. The fish transport trucks or AVs would haul fish from the FSS and traverse approximately 300 ft on NF- 1993 before exiting onto the Corps-owned quarry road to the east side of the South Fork McKenzie River to the AFCF release site.

3.23 Aesthetic Resources

Steep forested slopes, narrow small creeks, and diverse forest types characterize the Cougar Reservoir area. The reservoir itself is approximately six miles long, narrow, and deep. Many small drainages in well-defined ravines enter the lake on either side. Reservoir slopes are steep, with relatively little flat land adjacent to the water. USFS has been partly successful at revegetating some slope locations and massive rock walls from construction blasting remain vegetated. As a 450 ft-concrete dam paired with a 350 ft-tower, Cougar Dam and the WTCT are visually striking in this rural forested area.

The South Fork McKenzie River below Cougar Dam flows through forested land valued for its mature, old growth vegetation and hardwoods providing fall color. The corridor has an overstory of Douglas fir, western red cedar, and western hemlock. The existing wetland and side-stream areas host tree communities of alder, cottonwood, and willow. Sedges, understory shrubs, and forbs also populate the river corridor. The scenic quality of the forest, along with visually appealing water features of pools, riffles, meandering channels, and water clarity, contribute to this segment’s Outstandingly Remarkable Value of scenery as noted in the river’s Wild and Scenic River eligibility study (USDA Forest Service, 1992).

WFN manages the lands surrounding Cougar Reservoir with visual quality objectives of "preservation" (wilderness area: ecological change only), "retention" (in general, human activities not evident to the casual forest visitor) and "partial retention" (in general, human activities may be evident but subordinate to the characteristic landscape) (Forest Service, 1990). USFS manages lands along the South Fork McKenzie below Cougar Dam for "partial retention.”

[14] https://www.publications.usace.army.mil/USACE-Publications/Engineer-Manuals/

Cougar Reservoir is accessed from SR 126, which parallels the McKenzie River from the Eugene-Springfield area to east of McKenzie Bridge, just past Delta Campground to Forest Service Road 19, designated the Robert Aufderheide Memorial Drive National Scenic Byway. Aufderheide Drive is part of the West Cascades National Scenic Byway and is itself one of the earliest scenic byways in the state of Oregon. First designated in 1988, Aufderheide Drive is prized for its views of fall foliage and vistas allowing for views of rocky outcroppings, talus slopes, and cliffs primarily above Cougar Dam. The Byway parallels the South Fork McKenzie, provides access to the Corps overlook at Cougar Dam, parallels the south reservoir's entire length, and continues along the South Fork McKenzie State Scenic Waterway (and national study river). In total, the Aufderheide Scenic Byway parallels the McKenzie South and North forks for 70 miles on Forest Road 19 (Forest Service, 1990). Cougar Reservoir may also be accessed by driving National Forest Road 500 (NF-500) around the east side of the reservoir. NF-500 is narrow (approximately 10-12 ft wide) and is not maintained. Apart from the Road 19 bridge, most views of the river within the project area are blocked by dense vegetation between the road and the river. The 2017 AADT counts for SR 126 at the Cougar Dam Road (milepost 45.37) is 3000 (ODOT 2017). The river and reservoir within the project area may also be viewed from dispersed recreation sites (fishing spots and campsites) along Aufderheide Drive and National Forest Road-1993 along the east side of Cougar Reservoir.

In addition to its listing as an eligible Wild and Scenic River, South Fork is recognized for its scenic quality through a number of designations. It is a defining feature of the Aufderheide Scenic Byway and the state of Oregon has designated it as a State Scenic Waterway.

3.23.1 Environmental Consequences

3.23.1.1 Alternative 1. No Action

The No Action Alternative would have no direct, indirect, or cumulative effects on the current scenery conditions in the project area.

3.23.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Under Alternative 2, project construction may result in moderate, short-term impacts to scenery during 30 months of construction. The Cougar Reservoir pool lowering during the first year of construction would expose denuded rock areas and mud banks that are visually degrading and make access difficult. However, once the Corps recommences normal operations and rehabilitate the FSS construction site and staging areas to their pre-construction conditions, scenery impacts would be the same as those under the No Action Alternative. A barge-like structure on a similar scale to Cougar Dam and WTCT, the FSS would likely add to visual interest the dam and WTCT already provide.

3.24 Cultural, Archeological and Historical Resources

The NHPA requires federal agencies to evaluate the effects of a federal action on historical, archaeological, and cultural resources. The NHPA also requires agency to provide the Advisory Council on Historic Preservation an opportunity to comment on the proposed undertaking. The NHPA further requires the agency to consult with the State Historic Preservation Office (SHPO) and federally recognized Native American tribes or Native Hawaiians. For the purposes of this EA, cultural resources include precontact and historic archaeological resources, architectural or built environment resources, places and locations important to Native Americans and other ethnic groups, and human remains. Historic properties, a type of cultural resource, are any precontact or historic district, site, building, structure, or object included in, or eligible for, inclusion in the National Register of Historic Places (National Register). The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization that meet the National Register criteria. Historic properties and cultural resources are located within the proposed project area, including archaeological, historic, and built structures. For the purposes of NHPA, the project area includes the reservoir, staging areas, access routes, and dam itself.

Data on the earliest known settlement within the Willamette Valley is sparse. Archaeological evidence suggests settlement began during the Terminal Pleistocene/Early Holocene (ca. 13,000 to 7,500 years ago) era (Aikens et. al. 2011). Clovis points - a distinctive projectile point, date to ca. 12,000 years before present throughout North America - have been recovered in the Willamette Valley. Willamette Valley Clovis points have been identified near Springfield (Mohawk Valley), Cottage Grove, and Fern Ridge and Blue River Reservoirs. Just north of the Cougar Reservoir area within the foothills of the western Cascade Range, Cascadia Cave rock shelter (35LIN11) shows evidence of the early Holocene period (Minor et al 1982; Minor et al 1987p; and Minor and Pecor 1977). The Baby Rock Shelter site (35LA53) is also located within the Western Cascades. Baby Rock Shelter, heavily looted prior to recordation in 1969, shows use during the Early to Middle Holocene (7,500 – 3,000) and into the post-contact period, as evidenced by a red pictograph of what may be a horse with rider (Minor et al 1987 and Aikens et. al. 2011).

Ethnographic research for the Cougar Dam and Reservoir area suggests Native inhabitants were highly mobile. The Molalla and Kalapuya primarily used the western Cascade Mountains, though there are oral histories documenting groups from the eastern side of the mountains would travel west over the mountains as well. The mountainous terrain and seasonal weather patterns were ideal for hunting, fishing, and harvesting plants for food and fiber for basket weaving or clothing (Bergland 1991).

The Molalla people had three subgroups: the Northern Molalla (Mount Hood drainage system into the Willamette Valley), the Southern Molalla (Klamath Lake area), and the Upper Santiam/Santiam band of Molalla. Little is known of the Upper Santiam/Santiam band, thought to occupy the Linn and Lane county areas in between the northern and southern groups (Kelly and Fox 2014).

In the 1850s, the federal government began treaty negotiations with Pacific Northwest Indian tribes. In western Oregon, the United States government negotiated and signed various treaties with western Oregon Tribes. The Dayton, Kalapuya, and Molalla treaties of 1855 were signed by the Molalla, Kalapuya, Clackamas, some Chinookan bands or tribes, and various other Willamette Valley groups, and moved many to the Grand Ronde Encampment, today known as the Grand Ronde Reservation located in the northern Oregon Coastal Range. Molalla peoples also moved to the Siletz Reservation, located on the Oregon Coast, the Klamath Reservation in south central Oregon, and east to the Warm Springs Reservation. Continued research by the WNF archaeologist and contractors suggest that primarily indigenous peoples of the Cascades, most probably ancestors of the Molalla people, inhabited the Cascade Range. Native American artifact types suggest that Native Americans used the area for tool manufacturing or modification. The most prevalent tool types are those utilized for hunting and gathering of resources. (Minor et al 1982 and Minor et al 1987)

European exploration within the Willamette Valley began in 1811 by John Astor’s Pacific Fur Company’s fur trader Robert Stuart, who headed a party to ascertain feasibility of a trading post along the banks of the Willamette River in the valley’s interior. The following year, Donald McKenzie led a party up the McKenzie (Minor and Pecor 1977; Minor et al 1987). By 1813, French Canadian fur trappers began settling the Willamette Valley. While Eugene City was in development (1846), the foothills and mountain passes of what would become the WNF were exploited for natural resources such as trees and big game. A secondary use for the Cascades by Europeans were travel routes to the east side or, more importantly, for homesteaders coming out West.

In 1862, Felix Scott Jr. moved cattle and men east over an old Indian trail past Belknap Springs to Idaho; his route became known as the Scott Trail. The Scott Trail was rerouted by 1864. In 1874, the McKenzie Salt Springs and Des Chutes Wagon Road Company established a toll at McKenzie Bridge - then Blue River - which charged emigrant wagon trains crossing into the Willamette Valley from Central Oregon. In 1898, the route became a county road - the McKenzie and Eastern Oregon Road. In 1920, the Oregon State Highway Commissioners commissioned the road as McKenzie Pass. The road was widened, gradated, and resurfaced between 1920 and 1924; in 1925, the road became the McKenzie Pass Highway, part of Oregon Highway 126 (Williams 2018).

Historic uses of the project area consisted of travel routes over the mountain pass and the continued used of the area's natural resources (huckleberry gathering, for example) by the Warm Springs Indians from Central Oregon of (Minor et al 1987). The Indians from the Confederated Tribes of the Warm Springs Reservation of Oregon (Warm Springs) utilized trails over the mountain pass to the South Fork of the McKenzie River in late summer and fall in the early to mid-1900s. USFS employees noted that Warm Springs Indians harvesting the huckleberry fields, fishing, and engaged in big game hunting as well as pasturing their horses. The Warm Springs presence is also evident in areas of western red cedar and western hemlock bark collection areas (Bergland 1992). In the 1930s, USFS began to issue sheep grazing permits given that conflicts between the sheep herders and Indians over grazing grounds ended with Warm Springs Indians no longer grazing their horses in what would become the McKenzie Ranger District (Minor and Pecor 1977).

Between 1930 and 1942, the Civilian Conservation Corps (CCC) constructed the Box Canyon Guard Station on the Box Canyon Road along the north bank of the South Fork (n.d.). The CCC workers also maintained and constructed trails, many of which were originally Native American travel routes.

The National Register contains no sites in the proposed project area. The Corps began construction of the Cougar Dam in 1959, completing it in 1963. Cougar Dam exceeds the 50-year eligibility requirement for the National Register and a draft multiple properties nomination suggests that the Dam is eligible for its associations with Conservation and Biology and in the area of Architecture/Engineering (McCroskey, 2018 Draft).

A Corps archaeologist conducted an archival search internally at the Corps and using online sources to include the Oregon Archaeological Records Remote Access (OARRA). WNF conducted much of the early cultural research within and around the Cougar Dam and Reservoir area, focusing around proposed timber harvest and various management activities. Cougar Reservoir has six known archaeological resources. WNF initially identified and recorded four of these (35LA322, 35LA330, 35LA331, and 35LA594). In 1992, the Corps contracted Mountain Anthropological Research (MAR), who relocated the four previously recorded sites and identified three additional precontact sites (CR1, CR2 and CR3), eight precontact isolates[15] CI-3 through CI-10), and three historic isolates (CI-1, CI-2 and CI-11) (Flint and Nilsson 1993). The 1993 inventory report is not specific on the elevation exposed for inventory; however, MAR site CR3 was recorded at an elevation of 1,440 ft. In 1994, the Corps contracted Heritage Resource Associates (HRA) to conduct archaeological testing of known sites located within Cougar and Blue River Reservoirs and formally recorded the sites because Flint and Nilsson did not formally

[15] An isolate is nine or less archaeological objects/artifacts; precontact or historic.

record the newly identified site or isolates (Oetting 1994). Oetting's assessment of CR1 was that there were insufficient resources to test or record as a site; CR2 was tested and assigned 35LA1125; CR3 was tested and assigned 35LA1126; the remaining four previously recorded sites (35LA322, 35LA330, 35LA331, and 35LA594) were also tested. No attempt to relocate isolates were conducted by HRA nor were any new isolates formally recorded. In 2016, HRA and Corps archaeologists conducted monitoring of the six formally recorded sites (van der Borg 2016). Though HRA's 1994 recommendation was that sites 35LA331 and 35LA594 were not eligible for the National Register, the Corps has determined the sites are unevaluated (van der Borg 2016).

A review of the Government Land Office/Donation Land Claim maps identified no historic resources. Historic aerials dating to 1936, 1939, and 1956 identified a bridge and structures within the Action Area. Further review of a 1940 (revised 1948) McKenzie Bridge Quadrangle, 125,000 scale, identified the bridge and the structures as the East Fork Guard Station. The bridge and structures were not identified on a 1927 McKenzie Bridge Quadrangle. A maintained, paved road (NF-1994) and bridge, crosses over the East Fork within the project area. This is in the general vicinity of the historic bridge and structures.

The Corps initiated consultation with the Confederated Tribes of the Grand Ronde Community of Oregon (Grand Ronde), the Confederated Tribes of the Siletz Indians (Siletz), and the Warm Springs and SHPO on September 28, 2018. Oregon SHPO responded on October 30, 2018, in concurrence with the area of potential effect (APE). Warm Springs responded on October 22, 2018. To date, the Corps has not received comment from the Siletz. Following consultation initiation, the Grand Ronde requested a meeting, which they hosted at The Confederated Tribes of Grand Ronde Tribal Governance Building on January 9, 2018. On February 5, 2017, the Corps hosted a field trip to the project site with Grand Ronde representatives. On November 6, 2018, the Corps provided the draft EA to the tribes listed above for advance review and comment: comments were received only from the Grand Ronde.

3.24.1 Environmental Consequences

3.24.1.1 Alternative 1. No Action

The Corps does not anticipate impacts to cultural resources under the No Action Alternative over the short term. Cougar Reservoir has six known sites that are currently unevaluated in the National Register as well as CR1 and eleven isolates. Four sites, (35LA322, 35LA330, 35LA331, and 35LA1126) are below the minimum conservation pool elevation (1532 ft) and should not be affected by this Alternative. During normal dam operations, the Corps annually draws down the reservoir for flood control. This continued fluctuation of the reservoir has exposed submerged archaeological and historical sites, subjecting them to erosion and displacement due to wave action. Exposed sites are also at a higher risk for vandalism. Visitors may also affect historic

properties located within recreational areas. The eleven isolates, CR1, and any other undocumented archaeological or historic resources occurring in these areas could also be lost or damaged due to dam operations.

The Corps anticipates no impacts under the No Action Alternative on Cougar Dam, an eligible resource to the National Register, over the short or long term.

3.24.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Under Alternative 2, there would be moderate impacts to cultural, archeological, and historical resources. Cougar Dam is eligible for the National Register and road modifications on the face of the dam embankment would adversely affect Cougar Dam as a property on the National Register. Though the Corps would construct the new mooring tower for the FSS adjacent to the dam, it should not adversely affect the dam's eligibility, as the dam's innovative fish facilities confirm eligibility (McCroskey, 2018 Draft).

An archival search on the SHPO OARRA database identified six unevaluated pre-contact archaeological sites within the project area. The construction drawdown would expose the six sites. Four sites (35LA322, 35LA330, 35LA331, and 35LA1126) are below the minimum conservation pool elevation (1532 ft); the two other sites (35LA524 and 35LA1125) and CR1 are located within the normal operating pool elevation. Site CR1 and Isolate 2 may be located within the proposed Sunnyside staging area. The remaining 10 isolate locations are equally vague. During the construction drawdown, the Corps will conduct an inventory of accessible lands below the 1,532 ft minimum conservation pool elevation, attempt to relocate noted isolates from 1993 (Flint and Nilsson), and assess the four exposed sites and any newly recorded archaeological and cultural resources for eligibility for the National Register. Staging areas, construction areas, access areas, and any Corps property exposed during the drawdown not previously inventoried would be assessed for cultural resources.

Under this Alternative, the Corps will assess Cougar Dam and Reservoir for eligibility to the National Register.

3.25 RECREATION

In the summer months, Cougar Reservoir is a popular place for birding, boating, swimming, and fishing. USFS specially designated Cougar Recreation Area surrounds Cougar Reservoir and the South McKenzie River below Cougar Dam to its confluence with the mainstem McKenzie River (Figure 59). It includes a ½-mile strip on either side of Forest Service Road 19 from Hwy 126 to Forest Service Road 1927 as well as Terwilliger Hot Springs, Hidden Lake Day Use Area,

areas surrounding Delta Campground, Slide Creek Campground, and Echo/East Fork Day Use and Boat Ramp.

The Cougar Reservoir attracts anglers, boaters, swimmers, and water skiers from early spring until fall (April - September). Camping is very popular throughout the river corridor in both developed campgrounds and in dispersed campsites. Since 1998 (amended 2013), a forest order has preserved the special quality of this popular and high use area, restricting camping to developed campgrounds in the Cougar Recreation Area (Order 18-2013-01-03). However, camping use on Cougar Reservoir is light, estimated to be 200 per year at the developed campgrounds and 300 per year at the dispersed (Darren Cross, USFS McKenzie District Ranger, personal communication, January 29, 2019) sites. There are two developed campgrounds near the reservoir, Slide Creek and Sunnyside. The popular Terwilliger Hot Springs, located along Rider Creek located just west of the reservoir, attracts an estimated 20,000 visitors (Darren Cross, USFS McKenzie District Ranger, personal communication, January 29, 2019). USFS McKenzie River Ranger office operates recreation facilities at Cougar. Anglers, water skiers, and picnickers use Echo/East Fork Day Use Area, Cougar Crossing Day Use Area, and Slide Creek Campground. Anglers primarily use Sunnyside Campground. Boat ramps are located at Echo, Cougar Crossing, and Slide Creek, and are usable at water surface elevations above elevation 1,635 ft.

Slide Creek Campground consists of 16 campsites (14 single, two multiple) within mixed conifers, which provide a wooded setting along the east bank of the Cougar Reservoir just 50 miles from Eugene, Oregon. Both campground and Slide Creek Day Use Area provide guests with drinking water, vault toilets, a boat ramp, ample parking, and a swimming beach. A separate parking lot is available for boat trailers. The campsites can accommodate tents, trailers, or RVs and come equipped with campfire rings and picnic tables. Slide Creek boat ramp and swim area is located in the Slide Creek Campground on the east side of Cougar Reservoir.

Echo/East Fork Day Use Area provides picnicking areas and a boat ramp. The Cougar Crossing Day Use Area is popular with boaters (kayak and rubber rafts) and floaters (tubes and rafts). An estimated 50 visitations per week at Cougar Crossing occurs during June, July, and August (Darren Cross, USFS McKenzie District Ranger, personal communication, 2019).

Recreators and sightseers heavily use Aufderheide Drive (Forest Service Road 19) to access Cougar Reservoir and South Fork McKenzie above the reservoir. The Corps provides two viewpoints, one on each side of the dam, and a downstream sightseeing area.

Due to the lack of rainbow trout hatchery releases above Cougar Dam, angling pressure is relatively light in Cougar Reservoir. Additionally, it is illegal to angle for bull trout in the Willamette Basin as well as to catch and keep them.

The area downstream of Cougar Dam along the South Fork McKenzie River includes a variety of recreation opportunities including fishing, camping, scenic driving, hiking, and boating. As part of the highly regarded McKenzie River fishery, fishing is a common activity along this segment of the South Fork McKenzie River. Easy access via Aufderheide Drive (Forest Service Road 19) and a network of user-developed trails lead to many popular fishing sites (USFS 2018). A spring chinook and summer steelhead fishery exist below Cougar Dam. Delta Campground is the only developed campground in the designated area below Cougar Dam. Recreators use the dispersed campsites that provide river access throughout the visitor season and fall to support hunting, while recreators typically only use other dispersed campsites not on the river during hunting season (USFS 2018).

Boating along the main stem of the McKenzie River is very popular - attracting visitors from around the world - and there are dozens of outfitters and guides leading visitors on fishing and rafting excursions. However, the section of the South Fork McKenzie River in the project area sees a low level of boating use, based on anecdotal observations by USFS field going staff as well as interviews with the local boating community and outfitters and guides (USFS 2018). There are no self-issue permits or other user data collection methods in place for general public use. There are no developed boat launches on the South Fork; however, boaters use a spur road near the lower South Fork Bridge for putting in or taking out. Implementation of USFS South Fork McKenzie River Restoration Project (started in 2018) would effectively eliminate recreational boating on a 4.2 mile stretch of the South Fork McKenzie River Downstream (USFS 2018). The introduction of 4,000 - 5,000 pieces of large wood into the river combined with a decrease in water depth in some areas due to flow spread into several channels makes the reach essentially impassible.

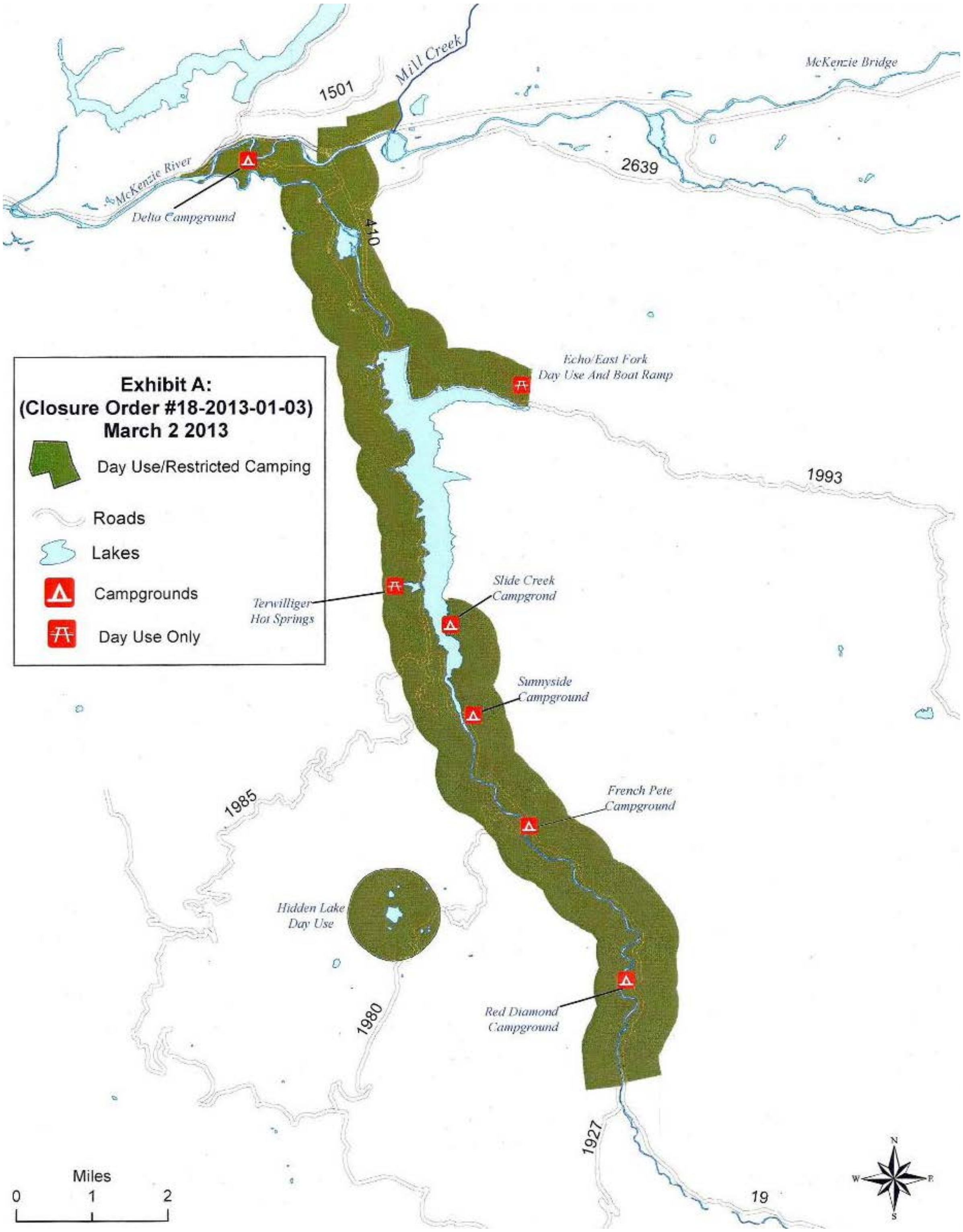

Figure 59. Map of Cougar Recreation Area (https://www.fs.usda.gov/detail/willamette/alerts-notices/?cid=stelprdb5424323).

3.25.1 Environmental Consequences

3.25.1.1 Alternative 1. No Action

The No Action Alternative would have no direct, indirect, or cumulative effects on recreational resources in the project's area of affect. The area would not realize potential benefits to recreational fishing correlated to a healthier and more robust fish population.

3.25.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Under Alternative 2, there would be short-term, moderate impacts to Cougar Reservoir boating access and scenic viewing (see Section 3.23) during the one-year drawdown; there would also be short-term, moderate impacts to recreational use of Slide Creek during construction duration. Appendix D provides a full report on the economic analysis for recreation impacts. The Corps requested visitation data from USFS, as USFS manages the recreational sites in the area. However, due to response efforts by USFS to the Terwilliger Fire which demanded numerous resources, as of the date of this EA, the Corps has not received requested data. For analysis purposes, based on data gathered from publically available resources, the Corps made the following assumptions:

1. As the campground is categorized as "medium" usage, campers use, on average, 10 of the available 16 campsites on any given weekend.
2. The campground is only open for 22 weeks (open from April thru September).
3. On average, campers stay for three days.
4. There are 3.8 people per vehicle.
5. There is only one vehicle per camp site.
6. As the campground has an improved boat ramp, 80% of campers bring boats with them and are considered boaters; 20% are not boaters.
7. All visitors travel more than 50 miles to get to the campground.
8. Visitors spend money within 30 miles of the campground.
9. The proposed drawdown would render all boat ramps on Cougar Reservoir inaccessible for one season.
10. The closure of the boat ramp at Slide Creek Campground for the remainder of construction following drawdown would have minimal adverse effects on opportunities to recreate on the lake, as recreators would be able to use Echo and Cougar Crossing boating access points as alternative water access points. Based on USFS experience, these access points would not be overburdened due to medium - low visitation experienced at Cougar Reservoir for these activities (Darren Cross, USFS McKenzie District Ranger, personal communication, January 29, 2019).

11. There are no non-local day users, as this type of recreator would be required to drive approximately 50 miles or more to enjoy the recreational opportunities at Slide Creek Campground; recreators will find sufficiently similar recreational experiences requiring less driving.

As water access would be limited, the drawdown would have a moderate effect on shore use, swimming, and boating. However, this effect would be short term and temporary in nature, lasting a single summer season. As described in Section 3.13.1.2, the Corps expects reduced flows to around 200 cfs in the South Fork McKenzie River below Cougar in the summer months as Cougar will only be passing inflow during the construction drawdown. However, the Corps does not expect this to effect downstream boaters. Figure 60 shows how South Fork McKenzie experienced similar flows during normal operations in recent summers without affecting boaters.

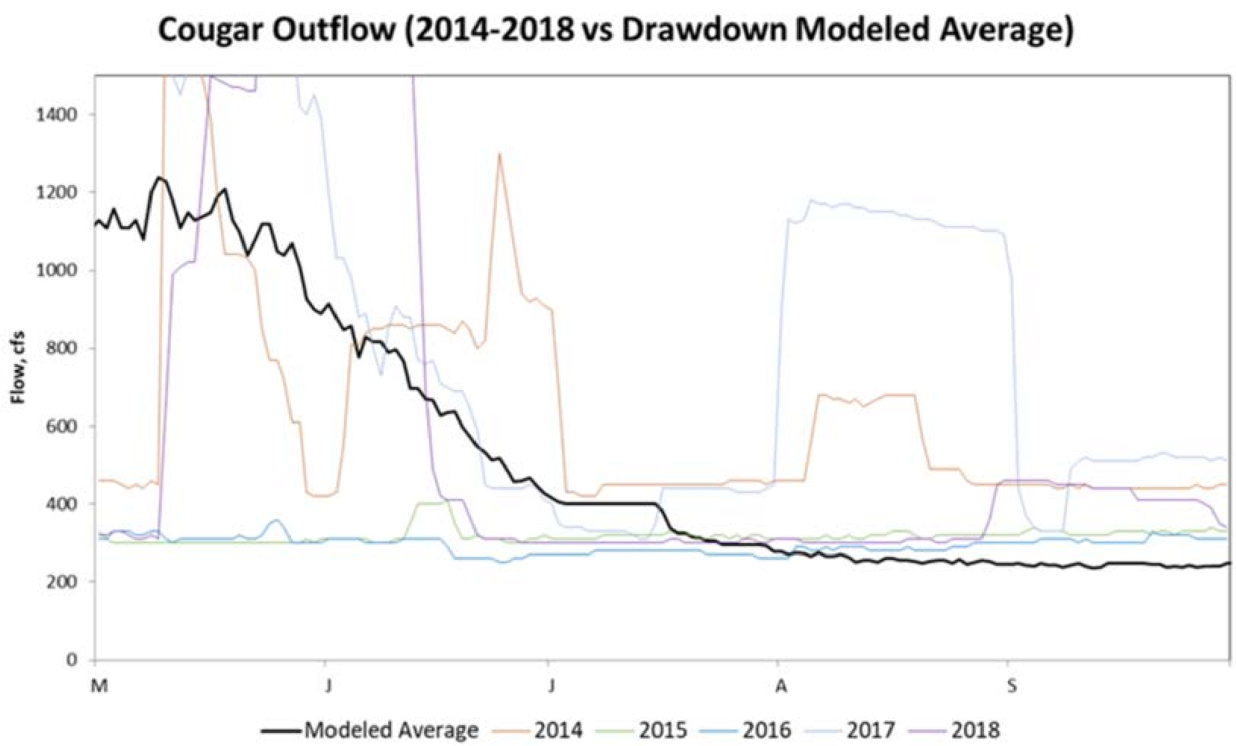

Figure 60. Cougar Dam summer outflows 2014-2018 vs drawdown modeled average.

Based on the assumptions above, Alternative 2 would have moderate recreation effects. However, these impacts would be temporary in nature, ceasing once construction is complete. The Corps estimates 2510 campers use Slide Creek Campground in any given year; 80% of these campers are estimated to be boaters using the available improved boat ramp to access the lake. Therefore, should this entire campground be used for construction purposes, approximately 7,530 recreators over the course of three years of construction would not be able to use Slide

Creek Campground. It is likely these visitors would use alternative nearby recreation areas such as facilities located at the Echo Boat Ramp and at Blue River Reservoir. Echo Boat Ramp and Day Use facilities may experience crowding due to their use by recreators unable to utilize Slide Creek. Increased construction traffic would also have minor impacts to recreators, as discussed in Section 3.22. Additionally, the impacts to aesthetics discussed in Section 3.23 would also affect recreators, as the aesthetic quality of the area is a major draw for recreators, although the view of a large construction site may be of interest to some recreators driving through the area.

The Corps anticipates effects to recreators downstream of Cougar Dam associated with reduction in flow to be similar to those experienced in the No Action Alternative. Although Cougar Dam will likely pass inflows during the summer months (July - November) during the drawdown and flows may get as low as 200 cfs (Figure 33), Cougar flows have reached similar lows - 275-300 cfs - in recent years and similar low flows are expected to occur under the No Action Alternative.

3.26 SOCIO-ECONOMICS

Lane County's population, employment and personal income have grown considerably over four decades, demonstrating Lane County's desirable living conditions. For instance, from 1970 to 2016, the population in Lane County grew from 216,409 to 369,519, a 71% increase (Figure 61 provides a historical trend overview with regard to these three metrics (population, employment, and personal income).

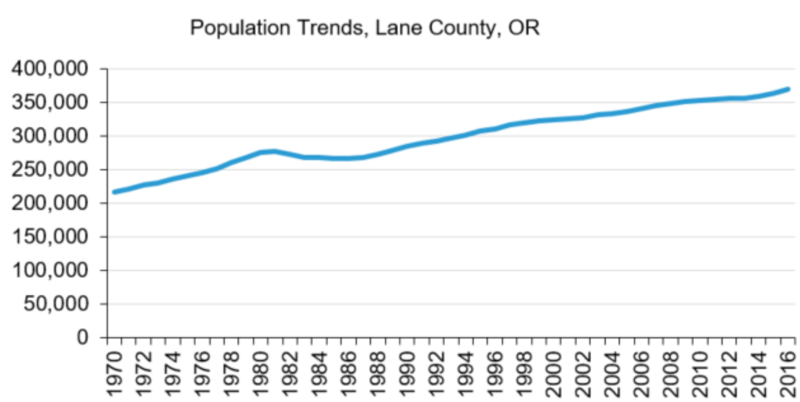

Figure 61. Population Trends – Lane County, Oregon.

Table 13. Overview of Socioeconomic Metrics (Population, Employment and Personal Income)

	1970	2000	2016	Change 2000-2016
Population	216,409	323,492	369,519	46,027
Employment (full & part-time jobs)	85,936	186,730	204,742	18,012
Personal Income 2017 ($K)*	4,949,679	11,993,622	15,478,644	3,485,022
Population and personal income are reported by place of residence, and employment by place of work, as reported by US Census Bureau. *Income from wage and salary employment and proprietors' income, as well as non-labor income (dividends, interest, rent, and transfer payments) reported by place of residence. All income figures in this report are shown in real terms (i.e., adjusted for inflation). Subsequent sections of this report define labor earnings and non-labor income in more detail.				

The average Annual Population Change for Lane County from 2000 – 2016 shows an increase of 3,060 per year (Figure 62). This indicates continual desirability of socioeconomic conditions within the county, along with its "livability". Good climate, schools, affordable housing, and job prospects have helped increase migration as the economy shifted away from timber and agriculture-based businesses to services, manufacturing of transportation equipment, printing and publishing, and high technology.

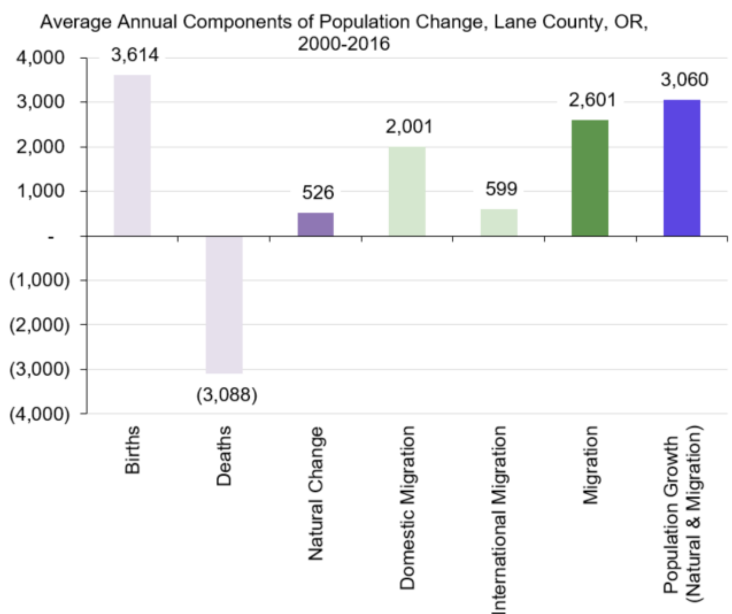

Figure 62. Average Annual Components of Population Change – Lane County, OR, 2000-2016.

In 2000, the three industry sectors with the largest number of jobs were services (57,940 jobs), retail trade (33,647), and government (27,176 jobs). From 1990, the annual unemployment rate ranged from a low of 4.3% in 2017 to a high of 12.3% in 2009. Figure 63 and Figure 64, respectively, compare the wages and employment by industry in Lane County. In 2006, trade, transportation, and utilities jobs employed the largest number of people (104,096), and natural resources and mining employed the smallest (22,006 jobs).

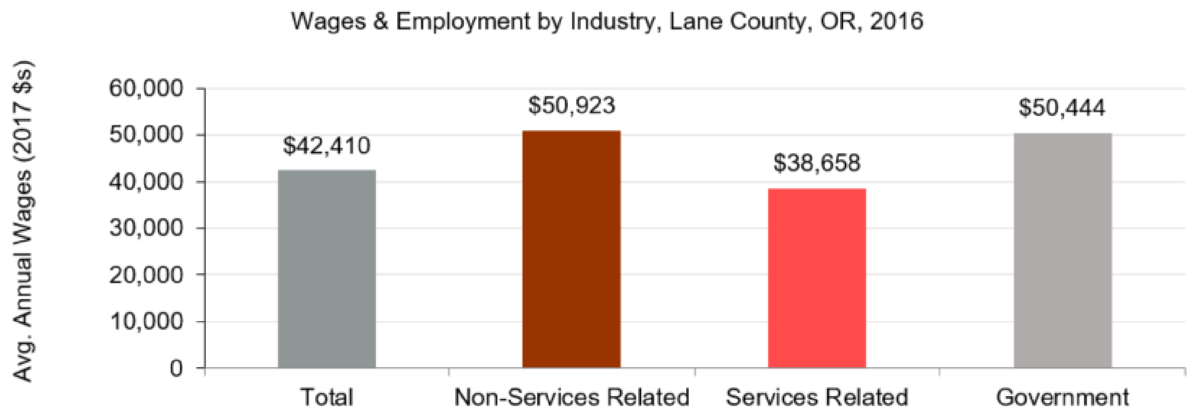

Figure 63. 2016 Wages and Employment by Industry, Lane County, Oregon

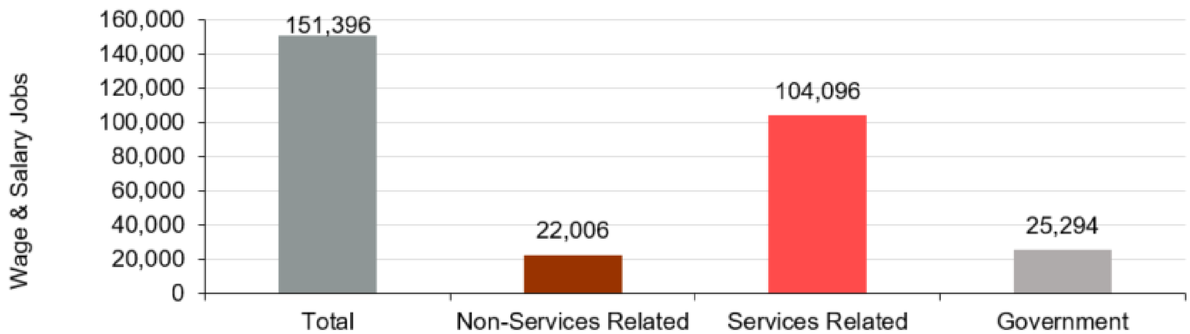

Figure 64. Jobs by Major Industry Category – 2016.

The Upper McKenzie River Valley, where the project is located, is an area of dispersed rural homes around nucleated settlements such as, Vida, Nimrod Blue River, and Rainbow. Upstream of Blue River, public ownership (Forest Service) dominates, leaving settlement primarily in the narrow river valley and the private lands downstream of Blue River and Finn Rock (Figure 2). Downstream of Blue River, BLM lands limit development; however, around Vida and Leaburg, most lands are private (Figure 2). Local citizens report recreation has always been part of the McKenzie River Valley economy but in recent years, recreation, along with retirement, drives the dollar economy. The lack of year-round tourism is problematic for the community because low season makes it difficult to maintain profitable businesses. However, businesses do have a reputation for "hanging on". Of note, many locals oppose new development, as they enjoy the solitude the McKenzie River Valley provides.

The economy seasonality has been recorded for many generations and remains important. Seasonal workers are local youth, working mothers, and other local people. USFS hires youth for the summer and provides District housing. Having multiple income streams has been a means

of survival for many families in an area where long-term, year-round, family-wage jobs have been uncommon.

3.26.1 Environmental Justice

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies. Meaningful Involvement means:

- People have an opportunity to participate in decisions about activities that may affect their environment and / or health;
- The public's contribution can influence the regulatory agency's decision;
- The public's concerns will be considered in the decision making process; and Decision-makers seek out and facilitate the involvement of those potentially affected.

The Corps must provide meaningful public involvement to minority and low-income populations. Public involvement must provide an opportunity for minority and low-income populations to provide input on the analysis - including demographic analysis that identifies and addresses potential impacts - on these populations that may be disproportionately high and adverse. The public involvement process can also provide information on subsistence patterns of consumption of fish, vegetation, or wildlife. The Corps should disclose information on proposed actions and alternative(s) that are likely to have a substantial effect on potentially affected populations and for Comprehensive Environmental Response, Compensation, and Liability Act sites.

All construction, operation, and maintenance activities for the proposed action and alternatives will be on federal lands. All activities and any potential release of contaminants or regulated substances that could adversely affect the environment will remain on federal lands or will be contained within navigable US waters. A review of demographics within the bounds of the areas potentially affected (Cougar Reservoir downstream to the confluence of the McKenzie and Willamette Rivers) by future activities does not reveal any potential demographic to be unduly affected by a potential negative environmental consequence because of Corps operations or policies.

After a thorough review of the area potentially affected by the proposed action, no group of people appears to bear a disproportionate share of the potential negative environmental

consequences resulting from actions or negligence of a federal employee, its contractor(s), or agent(s).

Public involvement will be provided by a public review of the Environmental Assessment, through the customary 30-day public review period. Should a particular demographic be identified for potential adverse effects by future government actions, the review period will immediately stop and renewed planning efforts will commence until an appropriate alternative is in place to avoid or completely ameliorate any environmental consequence that disproportionally affects any one demographic group.

3.26.2 Environmental Consequences

In general, the Corps determines the significance of socioeconomic impacts by the magnitude and duration of the impacts, whether beneficial or adverse. Factors to consider that may be applicable to socioeconomic resources include, but are not limited to, situations in which the proposed action or alternative(s) would have the potential to:

- Induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area);
- Disrupt or divide the physical arrangement of an established community;
- Cause extensive relocation when sufficient replacement housing is unavailable;
- Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities;
- Disrupt local traffic patterns and substantially reduce the levels of service of roads serving an airport and its surrounding communities; or
- Produce a substantial change in the community tax base.

Appendix D provides a full report on the socioeconomic analysis. As Cougar Reservoir is more than 50 miles from Springfield and Eugene Oregon communities, which are the closest communities consisting of sufficient size to have noteworthy local public services, the impacts of the proposed alternatives upon public services and social conditions would not be included in this analysis. The Corps assumes that the potential impacts to social services are not measurable, since residents of hamlets between Springfield and Cougar Reservoir primarily provide the social services within these unincorporated communities.

3.26.2.1 Alternative 1. No Action

The No Action Alternative would have no direct, indirect, or cumulative effects on socioeconomic resources in the project’s area of affect.

3.26.2.2 Alternative 2. Floating Screen Structure with Trap and Haul

Under Alternative 2, minor, short-term effects on socioeconomic resources may occur:

- The McKenzie River area is expected to experience a brief spurt in economic activity during construction of the project, as construction crews would frequent grocery stores, gas stations, and restaurants within the Rainbow community and possibly other nearby unincorporated communities.
- The largest decline in sales would result in a reduction of camping fees collected by USFS and reduced revenues in local restaurants. Based on recreationist expenditures when visiting the campground, the regional economic analysis (the RECONS model) revealed that this income to the community could support the hiring of one additional person. Without the campground available to recreationists, the regional economic analysis (the RECONS model) showed revenue loss generated by campers to be equivalent to the loss of one job within the 30-mile radius of Slide Creek Campground should the campground close for one year (one recreation season).
- No residents would be relocated, as all construction (and future operations and maintenance) of Alternative 2 would occur on federal land.
- It is unlikely to cause extensive relocation of community businesses and cause severe economic hardship for affected communities as there would be ample warning and potential adverse impacts would be temporary. In the end, the return of anadromous fish may indeed improve potential business opportunities for outriggers and guides.
- Disruption of local traffic patterns and a substantial reduction in service levels of roads serving an airport and its surrounding communities would be minimal. Alternative 2 would only affect recreators who wish to camp in one of USFS's campgrounds either adjacent to or upstream of the reservoir. Numerous other campgrounds exist within close proximity of the proposed action, and the Blue River Reservoir could serve as a potential substitute for campers who wish to recreate in a construction-free lake.
- It is unlikely to produce a substantial change in the community tax base. There is no sales tax in Oregon, so the bump in business activity due to construction would not result in increased revenues from sales. The individuals the Corps would hire to operate and maintain any constructed structure(s) are not expected to purchase homes in the area given that incomes will unlikely support the purchase; therefore, any potential increase in property tax is expected to be minimal. Potential impacts due to increases in income tax received by the state of Oregon is not expected to result in an increase in services to the area due to the small number of residents who reside within the non-incorporated communities of the McKenzie River between Springfield, Oregon, and Cougar Reservoir.

In summary, the proposed action may have a temporary effect on some business opportunities within the McKenzie River Valley with some, if not all, of the effect offset by the temporary bump in economic activity resulting from construction and the permanent effect of additional employees being required for operation and maintenance of the proposed action.

3.27 Climate Change

To date, the most comprehensive study of climate change in the Pacific Northwest is the “Pacific Northwest Hydroclimate Scenarios Project (2860)”, which is also referred to as the Columbia Basin Climate Change Scenarios Project, or simply the Climate Impacts Group analysis (Climate Impacts Group, 2010). Datasets generated as part of the Climate Impacts Group study were used by the Oregon Climate Change Research Institute (OCCRI) to write a report for the Corps’ Portland District titled, “Historical Trends and Future Projections of Climate and Streamflow in the Willamette Valley and Rogue River Basins” (OCCRI 2015). The OCCRI report describes general climate projections for 2030-2059 as having higher regional minimum and maximum temperatures, meaning that both winters and summers will be warmer, with a greater increase in summer temperatures than winter temperatures. The predicted amount of precipitation varied among the models by season and whether the model predicted a decrease or increase in precipitation (OCCRI, 2015).

Willamette Water 2100 (Jaeger et al., 2017) examined the interactions of humans, hydrology, and ecology on water supply in the Willamette River Basin. In the case of precipitation, the three climate scenarios evaluated by Willamette Water 2100 indicate that winters will become slightly wetter and summers slightly drier, but based on the examination of more than 40 climate models, there is no consensus about whether the Willamette River Basin’s climate will become wetter or drier overall (Jaeger et al., 2017). Snowpack may be dramatically reduced, and in areas where streamflow depends on snowmelt, would experience reduced flows that arrive earlier in spring and summer than has been the case historically. However, because spring precipitation plays a much larger role than snowpack in determining spring and summer flows, the reduction in snowpack would likely have little effect on the water supply humans use in the lower basin (Jaeger et al., 2017).

At the Cougar Project specifically, the OCCRI report considers Cougar to have high streamflow sensitivity, largely due to its high elevation. The OCCRI report describes the Cougar project as exhibiting a projected increase in mean flow during the period December - March and a projected decrease in mean flow for May - September.

3.27.1 Environmental Consequences

3.27.1.1 No Action Alternative

In 2018, the Corps contracted the Northwest Fisheries Science Center to study utilize population-specific life cycle models to assess the potential influence of climate change on population viability under baseline (current) and proposed fish passage scenarios (Myers et al. 2018, currently under review). The life cycle model utilized two independently estimated data sets for spawner capacity: one data set was solely habitat-based and the other dataset utilized historical estimates of spawning capacity and escapement. The habitat-based model predicts habitat quality downstream of the Corps' WVS dams, which could result in Chinook salmon population declines in abundance from spawning habitat loss and increased adult mortality in freshwater. Based on predicted increases in summer water temperature, the spawning capacity model predicts a decrease in habitat capacity under the No Action Alternative.

However, results in the Myers et al. 2018 draft may overestimate climate change effects on downstream flow/water temperatures and Chinook salmon, due to reservoir influence on downstream flows and water temperatures. Myers et al. 2018 acknowledges the limitations in dam operation data files used in the analysis, which are based on past hydrology and do not reflect future climate predictions. It cannot be directly assumed that future changes in precipitation and air temperatures will result in similar changes in stream flows and water temperatures below Willamette dams. Reservoir volume significantly affects summer and fall flows and water temperatures below WVS dams. Because spring precipitation plays a much larger role than snowpack in determining spring and summer flows, the reduction in snowpack would likely have little effect on the supply of water for in the lower basin (Jaeger et al., 2017).

3.27.1.2 Alternative 2. Floating Screen Structure with Trap and Haul

Operation of the Alternative 2 would continue under a wide range of environmental conditions and the Corps would not alter facility maintenance in response to changes in the timing or magnitude of stream flows under climate change. Meyers et al. 2018 life cycle modeling also assessed climate change impacts under proposed fish passage scenarios, which could include Alternative 2. The life cycle modeling showed proposed juvenile fish passage at Cougar Dam further increasing spawner abundance, proportionately more so under the historically-based capacities scenarios than the habitat-based capacities. Under the parameters investigated, juvenile passage at Cougar Dam more than compensated for spawner abundance losses due to climate change. The model results also support reestablishing access to higher quality spawning and rearing habitats upstream of the dams under Alternative 2, which will likely be important to UWR Chinook salmon survival and recovery.

4. CUMULATIVE IMPACTS

Cumulative effects are defined as “the impact on the environment which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 C.F.R. § 1508.7). Cumulative impacts can result from individual minor actions which collectively have a measurable impact over a period of time in a specific geographic area. This section analyzes the potential cumulative impacts that may occur following implementation of the proposed action when considered with other past, present, and reasonably foreseeable actions.

The geographic boundaries and cumulative effects vary for each resource, but the boundary for this analysis has been limited to the South Fork McKenzie watershed and the project area as described in Section 1.14. Analogous to the resources evaluated in Section 3, this EA only evaluates actions on resources that could reflect a measurable, cumulative impact in the South Fork McKenzie watershed. Resources excluded from analysis include water supply, hydropower, and transportation/circulation covered in Sections 3.19, 3.21, 3.22, respectively. Furthermore, this analysis uses the same measurable threshold(s) to assess the social and environmental impacts for the No Action Alternative and the proposed action. In general, this EA only considers effects of a particular action or group of actions if they have a measurable cumulative impact by meeting one of the following conditions:

- Effects of several actions occur in a common location;
- Effects are not localized and contribute to effects of an action in a different location;
- Effects on a particular resource are similar in nature or affect the same specific resource element; and
- Effects are long term or permanent.[16]

Environmental impacts may result from many diverse sources and processes and the CEQ has guidance which states, “….no universally accepted framework for cumulative effects analysis exists,” but certain principles have gained acceptance and “the list of environmental effects must focus on those that are truly meaningful” (CEQ 1997). Assessing the cumulative effects resulting from an action may also involve assumptions and uncertainties because data on the environmental effects of other past, present, and reasonably foreseeable future actions are often incomplete or unavailable. As a result, cumulative effect analyses often express impacts on resources in qualitative terms or as a relative change. This EA uses the CEQ

[16] By definition, short-term impacts tend to dissipate over time and cease to contribute to the cumulative effects as the effects subside or become inconsequential.

framework for assessing cumulative effects and, as a result, expresses the potential impacts on resources in qualitative terms or as a relative change from current conditions.

This analysis evaluates the cumulative effects of implementing the No Action Alternative and Alternative 2 in association with the past, present, and reasonably foreseeable future actions summarized in Appendix A. Overall, minor adverse impacts to geology and soils, water and air quality, and vegetation and a small amount of fish and wildlife habitat would occur. However, these impacts are considered negligible as they are temporary and not contextually intense when considered alongside past, present, and reasonably foreseeable future actions. The EA discusses the potential cumulative effects associated with the No Action Alternative and Alternative 2 with respect to each resource category listed below.

4.10.1 Physical Processes and Resources

4.10.1.1 Air Quality, Noise

Impacts to air quality would occur because of past, present, and reasonably foreseeable future actions in the region including:

- Floodplain restoration and clean up construction activities;
- Fuels management, thinning, and harvest; and
- Transmission line installation and maintenance.

These actions may cause temporary localized adverse impacts to air quality and increases in noise conditions because of construction-related noise, vibration, and fugitive emissions. However, the Corps does not expect these actions to fundamentally alter air quality and noise conditions in the South Fork McKenzie River watershed when combined with the short-term construction impacts associated with Alternative 2 because federal air quality standards would minimize adverse impacts to air quality from future development. The No Action Alternative would not change the current conditions; therefore, the No Action Alternative will not have a cumulative effect on air quality. When combined with other past, present, and reasonably foreseeable future actions, the cumulative impacts of any of the alternatives would result in negligible impacts to regional air quality deterioration through emission of criteria air pollutants. Greenhouse gas emissions associated with downstream passage construction would be hard to discern in the regional context. The No Action alternative would not increase emissions and vehicle emissions from construction under Alternative 2 would be too short term and limited in nature as to not contribute to overall cumulative impacts.

4.10.1.2 Geology and Soils

As discussed above, direct impacts to geology and soils from implementing the proposed action would be minor and limited to construction activities. The Corps expects construction-related effects to of short-term duration and temporary in nature. Present actions consist largely of operations and maintenance actions that do not impact geology or soil characteristics. The effects of past, present, and reasonably foreseeable future actions, when combined with the No Action Alternative or Alternative 2, would have negligible effects on local geology or soil characteristics in the immediate project area.

4.10.1.3 Hydrology and Hydraulics

The combined effects from past, present, and reasonably foreseeable future actions would have negligible impacts to hydraulics and hydrology of the South Fork McKenzie River. Although past actions fundamentally altered flow regimes in the watershed, the Corps does not expect current and future actions cumulatively to change the course of the South Fork McKenzie River or magnitude of flows. Forest management and transmission line activities may affect runoff. However, there are buffers around all streams, limiting the effect on stream hydrology. Future development, construction activities, and other foreseeable future projects, in combination with population growth, would change the extent of impervious surfaces and associated runoff in the watershed. However, all projects, regardless of sponsor, are required to adhere to local, state, and federal stormwater control regulations and best management practices designed to limit surface water inputs, thereby minimizing future adverse effects to water quality. The Terwilliger Fire may also result in increased runoff; however, USFS and Corps actions will mitigate these impacts. Additionally, the Corps operates the Cougar Dam and Reservoir to regulate downstream flows in conjunction with other WVS dams and reservoirs to minimize adverse impacts to downstream reaches. Because the Corps operates the WVS as a collective system, while future actions may influence water resources, WVS operation would not allow these resources to result in significant cumulative impacts. Finally, past and present floodplain restoration projects, as well as future augmentation of sediment and wood, would have a beneficial cumulative effect on streamflow and flood storage processes (namely subsurface or hyporheic flow). Although the presence of Cougar Dam mitigates downstream flooding to private and public property, the addition of connected floodplain acres would also serve to attenuate peak flows. Therefore, the cumulative effect of past, present, and reasonably foreseeable future actions in combination with the No Action Alternative or Alternative 2 would have negligible effects on hydrology or hydraulics of the South Fork McKenzie.

4.10.1.4 Water Quality

A number of ongoing or planned actions in the watershed focus on improving water quality. These include operational or structural changes to the WVS under investigation by the Corps, and the implementation of more stringent non-point source pollution standards by the state e.g., the Three Basin Rule and TMDLs. These actions and stricter controls on foreseeable future projects would reduce short-term, adverse impacts and the Corps anticipates the actions will provide a long-term, cumulative benefit to water quality in the watershed. Forest management and transmission line activities may affect runoff. However, there are buffers around all streams, limiting stream water quality effect. Future development, construction activities, and other foreseeable future projects, in combination with population growth, would produce changes in the amount of impervious surfaces and associated runoff in the watershed. While future development could have localized negative impacts on these resources, even with the current regulatory regime, these resources are likely to suffer substantial cumulative losses. However, all projects, regardless of sponsor, are required to adhere to local, state, and federal stormwater control regulations and best management practices designed to limit surface water inputs. Future actions would add a negligible amount of impervious surfaces, in addition to other existing and anticipated construction activities, thereby minimizing future adverse effects to water quality. The Terwilligar Fire may increase available sediment leading to an increase in nutrients (especially phosphorus) transported into the reservoir. This may result in more blue-green algae bloom occurrences in the coming years, especially if summer inflows are below average. However, USFS and Corps actions will mitigate increases in available sediment through slope and road repairs. Past and present floodplain restoration projects, as well as future augmentation of sediment and wood, would have a beneficial cumulative effect on streamflow and flood storage processes (namely subsurface or hyporheic flow) which would contribute to improving water quality. Therefore, the combined effects from past, present, and reasonably foreseeable future actions, in combination with the No Action Alternative or Alternative 2 described above, would have negligible effects on water quality.

4.10.2 Biological Resources

4.10.2.1 Vegetation

The spatial boundaries for analyzing the cumulative effects to vegetation are limited to locations where vegetation will be affected including within the proposed construction areas of Slide Creek Campground and North Sunnyside as well as the existing switchback roadway located adjacent to the emergency spillway. With the exception of silvicultural practices and agriculture, the current operational and maintenance actions described above do not have substantial impacts on vegetation throughout the watershed. Past, present, and future USFS

vegetation management projects and BPA transmission line work do not overlap spatially with the area and would have no cumulative effect under the No Action Alternative or Alternative 2. Future development would likely increase the spread of invasive species. However, nonnative invasive species are currently present in almost all habitat types throughout the watershed, some of which alter functional vegetative characteristics and ecosystem processes. Reasonably foreseeable future action is unlikely to have a cumulative substantial impact on vegetative resources as initiatives by federal, state, and local agencies operate to reduce the spatial extent of nonnative species through restoration and best management practices for future development. The Terwilliger Fire burned areas in and around the Slide Creek Campground and North Sunnyside sites, resulting in large areas of burned vegetation. USFS and Corps actions to address impacts from the Terwilliger Fire will likely include vegetation management in areas overlapping the area directly affected by construction ideas resulting in negligible cumulative effects. Therefore, the combined effects from past, present, and reasonably foreseeable future actions, in combination with the No Action Alternative or Alternative 2 described above, would have negligible effects on vegetation.

4.10.2.2 Fish and Wildlife

While historic development in the watershed has caused losses of aquatic and riparian habitats, especially in the lower watershed, with resulting adverse impacts to fish and wildlife resources, these actions occurred in a regulatory landscape that is different from that which exists today. While future development would likely have localized impacts on these resources, under the current regulatory regime, these resources are unlikely to suffer substantial losses. The Corps bases this assumption on initiatives by federal, state, and local agencies and nongovernmental groups operating to mitigate unavoidable environmental impacts of future development and restore the extent and quality of habitats important to the region’s fish and wildlife.

Continued and future development of the South Fork McKenzie River watershed would continue to impact fish, wildlife, and the habitats upon which they depend. However, restoration actions throughout the Willamette Valley attempt to mitigate these impacts and improve the spatial extent, connectivity, and quality of aquatic, riparian, and terrestrial habitats. This includes the South Fork McKenzie River Restoration and Green Island Project that would directly benefit fish and wildlife in future. Restoration actions will improve the spatial extent, connectivity, and quality of aquatic, riparian, and terrestrial habitats. By providing greater habitat connectivity with these downstream restoration projects, Alternative 2 will have moderate beneficial cumulative effects. Future augmentation of sediment and large wood would benefit Harlequin Duck and Pacific Pond Turtle habitat by providing an ongoing addition of loafing sites on large wood structures. Bald Eagle fish prey would also benefit from future

sediment and large wood additions, in turn providing foraging benefits to eagles. Combined with the potential for increasing numbers of fish species resulting from downstream passage, Alternative 2 may have a moderate beneficial effect on habitat by providing additional prey. Moreover, improved fish passage at the Carmen Smith Hydroelectric Project will have beneficial cumulative effects with Alternative 2 on fish species by further improving access to upstream habitat. Given these measures, implementing the No Action Alternative or Alternative 2, in combination with the past, present, and reasonably foreseeable future actions, would have negligible cumulative impacts on fish and wildlife habitat throughout the South Fork McKenzie River watershed.

4.10.2.3 Threatened and Endangered Species

There are a number of ongoing or planned actions that would provide a cumulative, long-term improvement to fish resources and habitat, especially for ESA-listed salmonid species, including the implementation of the RPAs specified in the 2008 NMFS BiOp, implementation of the USFS South Fork McKenzie River Restoration project, and more stringent non-point source pollution standards such as TMDLs.

The operations and maintenance of the existing AFCF has had lasting impacts on adult ESA-listed fish populations. Together with other present and reasonably foreseeable future actions, the No Action Alternative would continue to have lasting impacts on these fish populations. The proposed action would provide a long-term, cumulative improvement to passage efficiency and ESA-listed fish resources throughout the watershed. Any future federal actions would require additional evaluation under the National Environmental Policy Act at development time.

Past, present, and future USFS vegetation management projects do not overlap spatially with the project area and would therefore have no cumulative effect on ESA-listed species in Cougar Reservoir and South Fork McKenzie. The fuels reduction projects have some overlap with the South Fork McKenzie River below Cougar Dam; however, USFS buffered all streams and, therefore, these actions will have no cumulative effect on ESA-listed species.

Improved fish passage at the Carmen Smith Hydroelectric Project will have beneficial cumulative effects with Alternative 2 on ESA-listed species by improving access to upstream habitat.

The operations and maintenance of the existing AFCF has had lasting impacts on adult ESA-listed fish populations. Together with other present and reasonably foreseeable future actions, Alternative 2 would provide a long-term, cumulative improvement to passage efficiency and ESA-listed fish resources throughout the watershed.

4.10.3 Social Resources

4.10.3.1 Aesthetics

The Corps does not expect the aesthetic value of South Fork McKenzie River watershed to change under present or future actions. The proposed action would add facilities similar in aesthetic to existing structures. Present actions in the watershed are largely operation and maintenance activities associated with the dam and reservoir, as well as land-use practices and development. The proposed actions proposed drawdown of the Cougar Reservoir would expose much of the lakebed, but aesthetic effects from the drawdown are temporary. While future actions, including the continued development of the South Fork McKenzie River watershed and silvicultural practices, may affect aesthetic value of the watershed, these actions occur in a regulatory climate where resources are regulated to minimize adverse effects to the human environment. As a result, the Corps does not expect the cumulative effects from implementing the No Action Alternative or Alternative 2 to have measurable impacts on aesthetics when evaluated in the context of past, present, and reasonably foreseeable future actions.

4.10.3.2 Cultural and Historical Sites

Cultural resources located within a reservoir environment are highly subject to erosion through wave action, changes to reservoir elevation levels, recreationists, and vandalism. The Terwilliger fire response may have cumulative effects with the No Action Alternative and Alternative 2 on the Project area. These include fire-associated landslides that may cover a site or sites and uprooted trees or large boulders that tumble down slope, such as along the reservoir, which could adversely affect a site by scouring or abrading the soil and displacing a site.

4.10.3.3 Recreation

Recreational use of the Cougar Reservoir is highest in the summer months. Present actions, including road closures for the Terwilliger Fire Response actions, are likely to result in short-term interference to recreation. However, the Corps does not expect these effects to affect region socioeconomics. Construction of the proposed action may, however, have short-term impacts on recreational activities. Construction traffic would increase in the project vicinity, but the Corps does not expect these effects to affect recreational use of the watershed.

Future population growth and development of the watershed would likely increase the amount of recreation occurring in the watershed. However, the Corps does not expect any increase in recreation to increase to such a degree as to inhibit use by members of the public or result in restrictions to recreation in the area. As a result, the cumulative effects from

implementing the No Action Alternative or the proposed action, when combined with the Corps does not expect past, present, and reasonably foreseeable future actions measurably to affect recreational use of the reservoir and surrounding forested landscape.

4.10.3.4 Socio-Economic

Past actions in the South Fork McKenzie River watershed have fundamentally changed the character of the watershed and allowed for the development of local communities and a regional economy through various land use practices and industries (silviculture and agricultural practices). Present actions in the watershed include operation and maintenance of the dam and reservoir, which support these communities and local economies. Current land use practices support region socioeconomics, funding local businesses and fueling the economy. The Corps does not expect effects of future activities and the continued development and use of the watershed to change measurably from current conditions.

The Corps does not expect implementing the No Action Alternative or Alternative 2 to effect local populations or other indicators of social well-being when evaluated cumulatively with past, present, and reasonably foreseeable future actions. The Corps does not expect population growth trends, and other indicators of social well-being, to remain consistent with existing conditions and the proposed action would not result in a disproportionately high or adverse effect on minority populations or low-income populations. Construction effects would not adversely affect communities in adjacent areas. The benefits implementing the proposed action are not expected to be substantial relative to normal trends (the No Action Alternative) and the cumulative effects of future actions and development activities is not expected to be measurable.

5. REVIEW AND CONSULTATION REQUIREMENTS

5.10 TRIBAL CONSULTATION

Tribal consultation for this project began in November 2017. The Corps consulted with the Grand Ronde, the Siletz Indians, and the Warm Springs. On November 17, 2017, the Corps mailed these Tribes a consultation letter that included information about the proposed project location and the purpose and need for the project. Additionally, the consultation invited the Tribes to provide any comments or concerns regarding the proposed project, or meet with project team members to discuss the project in more detail. The Grand Ronde requested a meeting, which they hosted at The Grand Ronde Tribal Governance Building on January 9, 2018. The Corps presented information about the proposed project location, proposed alternatives, and the project's purpose and need. Tribal members and staff present at the meeting expressed support for the project, a willingness to provide assistance and information if needed, and emphasized continued communication with them as the project progressed. On February 5, 2017, the Corps hosted a field trip to the project site with representatives from the Confederated Tribes of Grand Ronde. On November 6, 2018, the Corps provided the draft EA to the tribes listed above for advance review and comment.

5.11 CONSULTATION WITH OTHER AGENCIES

5.11.1 National Marine Fisheries Service and United States Fish and Wildlife Service

The Corps sent a letter to NMFS and USFWS on December 07, 2017, offering the opportunity to be Cooperating Agencies in preparation of an EA. The Corps received a letter from NMFS on June 19, 2018, and from USFWS on January 25, 2018, acknowledging the Corps as the project lead agency, accepting the invitation for NMFS and USFWS to be a Cooperating Agency in preparation of an EA. Additionally, the Corps and both agencies, along with the BPA and the ODFW, are a part of the Willamette Action Team for Ecosystem Restoration (WATER) and the Willamette Fish Facility Design Working Group (WFFDWG). The purpose of WATER and WFDWG is to provide a forum for coordination and recommendations among the participating members (federal/state/tribal) working to implement strategies for ESA compliance associated with the 2008 BiOp. These groups meet monthly.

5.11.2 Bonneville Power Administration

The Corps sent a letter to BPA on December 07, 2017, offering BPA the opportunity to be a Cooperating Agency in preparation of an EA. The Corps received an email from the BPA on July 09, 2018, declining the invitation for BPA to be a Cooperating Agency. Additionally, the Corps and BPA, along with NMFS, USFWS, and ODFW, are a part of WATER and WFDWG. The purpose

of WATER and WFDWG is to provide a forum for coordination and recommendations among the participating members (federal/state/tribal) working to implement strategies for ESA compliance associated with the 2008 BiOp. These groups meet monthly.

5.11.3 U.S. Forest Service

The Corps sent a letter to the USFS on December 07, 2017, offering USFS the opportunity to be a Cooperating Agency in preparation of an EA. The Corps received a letter from USFS on April 6, 2018, acknowledging the Corps as lead agency on the project and declining the invitation for USFS to be a Cooperating Agency in preparation of an EA. On April 25, 2018, the Corps met with the McKenzie District Ranger explaining the project purpose and potential impacts. The District Ranger offered to assist with traffic, wildlife, recreation, and cultural data to assist with the environmental effects analysis for the project EA. The Corps also coordinated heavily with USFS extensively following the Terwilliger Fire to ensure safe access to the project site.

5.11.4 Oregon Department of Fish and Wildlife

The Corps sent a letter to ODFW on December 07, 2017, offering ODFW the opportunity to be a Cooperating Agency in preparation of an EA. The Corps received a letter from ODFW on June 21, 2018, acknowledging the Corps as lead agency on the project and accepting the invitation for ODFW to be a Cooperating Agency in preparation of an EA. Additionally, the Corps and ODFW, along with the NMFS, USFWS, and BPA, are a part of WATER and WFDWG. The purpose of WATER and WFDWG is to provide a forum for coordination and recommendations among the participating members (federal/state/tribal) working to implement strategies for ESA compliance associated with the 2008 BiOp. These groups meet monthly.

5.11.5 Oregon State Historic Preservation Office

Consultation with the Oregon SHPO is underway.

5.11.6 Oregon Department of Environmental Quality

On May 9, 2018, the Corps communicated with representatives from ODEQ, explaining project purpose, proposed alternatives, and potential impacts. ODEQ representatives offered to provide input on proposed best management practices to address any water quality impacts.

5.11.7 Eugene Water and Electric Board

On May 8, 2018, the Corps communicated with a representative from EWEB, explaining the project purpose and potential impacts. The EWEB representative offered to provide existing

sediment and water quality data collected at sites below Cougar Dam to assist with the environmental effects analysis for the project EA.

5.12 Public Engagement

On February 8, 2018, the project team presented at the McKenzie Watershed Council monthly meeting (these meetings are open to the public). The Corps presented on the project purpose and need, proposed alternatives and alternatives screening process, EA schedule, and public review and comment opportunities. Attendees were afforded an opportunity to comment upon the presented materials and ask questions. Major concerns raised by participants included turbidity impacts associated with a deep drawdown for construction and the inclusion of operational alternatives in the alternatives analysis. Comments were utilized in the development of this EA.

In 2019, the Draft EA will be issued for a 30-day public review period. The Draft EA will be available for review on the Portland District's website.[17] Review comments will be requested from federal and state agencies as well as various interested parties. In anticipation of the release of the Draft EA for public review, the Corps plans to hold public meetings to provide an overview of the EA and inform participants on how they can access the Draft EA for review and commentary. The Corps will consider all correspondence and comments, and send the public notice for the release of the Draft EA for public review to interested persons, agencies, and groups including, but not limited to, those parties listed below:

National Marine Fisheries Service

U.S. Environmental Protection Agency

U.S. Fish and Wildlife Service

U.S. Forest Service

Bureau of Land Management

Confederated Tribes of the Warm Springs Reservation of Oregon

Confederated Tribes of the Siletz Indians

Confederated Tribes of the Grand Ronde Community of Oregon

Oregon Department of Environmental Quality

Oregon Department of Land Conservation and Development

Oregon Department of State Lands

Oregon Department of Transportation

Oregon Department of Fish and Wildlife

Oregon State Historic Preservation Office

Oregon State Marine Board

5.12.1 Draft EA Comments

To be completed following the Draft EA public comment period.

5.12.2 Response to Comments

To be completed following the Draft EA public comment period.

5.12.3 List of Commenters

To be completed following the Draft EA public comment period.

6. COMPLIANCE WITH APPLICABLE FEDERAL ENVIRONMENTAL LAWS AND REGULATIONS

This section presents and analyzes the federal statutes, implementing regulations, and executive orders that are potentially applicable to the proposed action. The Corps will ensure that the proposed action complies with applicable federal laws, regulations, and executive orders. Table 14 summarizes the major environmental compliance regulations and compliance status.

Table 14. Other Applicable Laws

Law	Status of Compliance
National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. §§ 4321–4347)	This EA has been prepared in compliance with the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the NEPA (40 C.F.R. §§ 1500–1508) and the Corps' Planning regulations. The Corps will consider and evaluate all agency and public comments. If appropriate, the Corps will sign a FONSI with a conclusion of no significant impacts from this proposed action.
Clean Air Act, as amended (42 U.S.C. §§ 7401–7671q)	The proposed action would take place in an attainment or unclassified (i.e., in compliance) area for all state and federal air quality standards. Air emissions from the proposed action would be localized, temporary, and minimal and is therefore in compliance with the Clean Air Act.
Clean Water Act, as amended (33 U.S.C. §§ 1251–1387)	Pursuant to section 401 of the CWA (33 U.S.C. § 401), the proposed action requires an individual 401 Certification from the ODEQ to ensure the project meets state water quality standards. The Corps is coordinating with ODEQ and will request a 401 certification for the proposed action. Section 404 of the CWA (33 U.S.C. § 1344) regulates the discharge of dredge or fill material into waters of the United States and within the lateral extent of wetlands adjacent to such waters. Pursuant to Section 404, the Corps has determined that the proposed action will result in the discharge of fill dredge or fill material into Waters of the United States and, therefore, a 404(b)(1) analysis will be completed. Section 402 of the CWA (33 U.S.C. § 1342) addresses the NPDES. ODEQ administers the NPDES program applicable to federal activities in Oregon. NPDES Construction General Permit No. 1200-C regulates stormwater runoff to surface waters from construction activities that disturb one or more acres in Oregon. Temporary impacts to water quality should be avoided and minimized during the project's construction and staging. The Corps will obtain any necessary NPDES permits and develop required monitoring plans to reduce construction-related erosion and runoff prior to construction.

Wild and Scenic Rivers Act (16 U.S.C. §§ 1271)	The Omnibus Oregon Wild and Scenic Rivers Act of 1988 called for the study of seven Oregon rivers to determine whether they are eligible and/or suitable for inclusion into the national system. A 25.7 mile stretch of the South Fork McKenzie River is one of the study rivers. The study river is divided into three segments, and the South Fork McKenzie River area of the proposed project is classified as a "recreation" river segment. As part of the 1992 eligibility study, the river was found to be free-flowing and the outstandingly remarkable values (ORVs) of scenery, recreation, fish, and prehistoric were identified. Scenery Outstandingly Remarkable Value For effects to ORV scenery, see the Section 3.23 of this EA. In summary, the proposed action will have short-term minor impacts on scenery. Fish Outstandingly Remarkable Value For effects to fish ORV, see the Sections 3.17 and 3.18 of this EA. In summary, the Corps expects the proposed action to have short-term minor impacts on native fishes in the South Fork during implementation, but the long-term benefit of improved downstream passage outweighs short-term impacts. Therefore, the project would not have an adverse effect on the fish ORV in the South Fork McKenzie River and instead, the project would benefit the fish ORV. Prehistoric Outstandingly Remarkable Value For effects to the prehistoric ORV, see the Section 0 of this EA. In summary, the Corps would protect from disturbance those areas known by the Corps to require special protection measures. If the Corps encounters heritage resources during project implementation, contract clauses will require the contractor immediately to cease all operations in the area and notify the Corps. A Corps archaeologist will be notified so that discovery can be evaluated and a course of action recommended. With these requirements in place, there would be no direct and adverse effects to the prehistoric ORV. Recreation Outstandingly Remarkable Value For effects to the recreation ORV, see the Section 0 of this EA. Because boating does not meet recreation ORV criteria, even though the proposed drawdown would essentially eliminate reservoir boating opportunities, the Corps does not consider the loss of boating a direct and adverse effect to the recreation ORV. Additionally, the 1992 Eligibility Determination summarized its findings as follows: "Recreation in Segments 2 and 3 meet criteria for an outstandingly remarkable value because of the variety of recreational opportunities available." This finding still holds true, with unaffected camping, hiking, fishing, and sightseeing activities with the exception of potential short-term impacts to camping at Slide Creek. Therefore, there would be no direct and adverse effects to the recreation ORV.
Executive Order 11990, Protection of Wetlands	Under this Executive Order, federal agencies shall take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance natural and beneficial values of wetlands. The proposed action would not result in destruction, loss, or degradation of wetlands and is therefore in compliance with Executive Order 11990.

Migratory Bird Treaty Act (16 U.S.C. §§ 703-712)	The Corps has determined that there would be no impacts to migratory birds (see Section 3.15) from the proposed action and, therefore, the proposed action complies with this act.
Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. §§ 668 *et seq.)*	This Act provides for the protection of bald and golden eagles by prohibiting the taking, possession, and commerce of such birds, except under certain specified conditions. Projects involving forestry practices, use of aircraft (or other motorized equipment), blasting, and other work may result in loud or intermittent noises if they occur within 1000 ft of an active or alternate nest time during the breeding season (January 1 - August 15) and could disrupt breeding activity. USFWS, National Bald Eagle Management Guidelines (May 2007), and the Corps eGIS Information Portal aided in evaluating project impacts to bald eagles and known nest locations. There are no active nests within 1000 ft of work under the proposed action. For this reason, the proposed action will not disturb bald or golden eagles and, therefore, complies with this Act.
Coastal Zone Management Act of 1972 (16 U.S.C. §§ 1451)	The proposed action would not occur in or near coastal waters. This statue is not applicable.
National Marine Sanctuaries Act (16 U.S.C. §§ 1431, *et seq.*) and the Marine Protection Research and Sanctuaries Act of 1972 (33 U.S.C. §§ 1401, *et seq*.)	The proposed action does not fall within a marine protected area or marine sanctuary. These statues are not applicable.
Marine Mammal Protection Act (16 U.S.C. §§ 1361–1421h)	The Corps has determined that there would be no impacts to marine mammals from the proposed action and, therefore, the proposed action complies with this Act.
Magnuson-Stevens Fishery Conservation and Management Act-Fishery Conservation Amendments of 1996 (16 U.S.C. §§ 1801–1883) – Essential Fish Habitat (EFH)	Relevant fish resources pertinent to the project area, based on Oregon coastal fishery resources, include UWR Chinook salmon. Accordingly, the McKenzie and South Fork McKenzie Rivers are designated as Essential Fish Habitat (EFH) for Chinook salmon, as they provide waters and substrate necessary for spawning, breeding, feeding, and growth to maturity. The NMFS 2008 BiOp provided conservation recommendations to avoid and reduce adverse effects to EFH (blocking habitat, modifying flows, and degrading water quality), according to the RPA. Pursuant to the adoption and implementation of the RPA, the adverse effects to EFH would be minimized. The Corps proposes this action as a method to alleviate fish passage issues and conserve EFH at Cougar Dam and to improve passage. As a result, the proposed action meets the RPA and, therefore, complies with this Act.

Endangered Species Act as amended (16 U.S.C. §§ 1531–1544)	In accordance with Section 7(a)(2) of the ESA of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed or proposed threatened or endangered species. This EA presents information on federally-listed fish and wildlife species and designated critical habitat (see Section 3.18). The NMFS 2008 BiOp addresses this project. The proposed construction, operations, and maintenance actions associated with these facilities are a part of RPA, Measure 4. The operations and maintenance of this project would improve passage conditions, providing beneficial effects to passage and survival. The 2008 USFWS BiOp for bull trout addresses affects on these species because of the fish collection facility project (USFWS 2008b). Any action that may adversely affect key prey species of Southern Resident Killer Whales (SRKWs), which includes UWR Chinook, has the potential to affect SRKWs adversely. The 2008 BiOp determined that the RPA was Not Likely to Adversely Affect SRKWs, so in carrying out the RPA, this project complies with the ESA concerning effects on listed marine mammals. The Corps coordinated early with USFWS regarding potential effects on other listed species under the jurisdiction. Based on the lack of presence in the project area and timing of specific project elements, the Corps made a “no effect” determination for northern spotted owl and red tree vole and their critical habitat for construction activities associated with the downstream passage (See Section 3.18).
Fish and Wildlife Coordination Act (16 U.S.C. §§ 661 *et seq.*)	The proposed action will not impound, divert, channel deepen, or otherwise control or modify a body of water. These statues are not applicable. However, the project team did informally coordinate with USFWS and NMFS on FWCA applicability and they concurred with the Corps’ determination. These agencies were provided the opportunity to review and comment on the EA.
National Historic Preservation Act (54 U.S.C. 306108): Protection of Historic Properties	This Act requires that federal agencies evaluate the effects of federal undertakings on historical, archeological, and cultural resources, and afford the Advisory Council on Historic Preservation the opportunity to comment on the proposed undertaking. The Corps, in coordination with the SHPO and Native American tribes, is identifying cultural resources and sites in the project areas for inclusion on the National Register. Currently the Corps is in consultation with the Grand Ronde, Warm Springs, and Siletz tribes as well as the Oregon SHPO.
Executive Order 11593: Protection and Enhancement of the Cultural Environment	See above.
Executive Order 13175: Consultation and Coordination With Indian Tribal Governments (2000)	Executive Order 13175 reaffirms the federal government's commitment to tribal sovereignty, self-determination, and self-government. Its purpose is to ensure that all executive departments and agencies consult with Native American tribes and respect tribal sovereignty as they develop policy on issues that impact Native American communities. Currently, the Corps is in consultation with the Grand Ronde, Warm Springs, and Siletz tribes
Native American Graves Protection and Repatriation Act (25 U.S.C. §§ 3001-3013)	This Act addresses the recovery, treatment, and repatriation of Native American and Native Hawaiian human remains and cultural items (associated funerary objects, unassociated funerary objects, sacred objects, and objects of cultural patrimony). The implementation of any drawdown measure could result in the exposure of Native American human remains and cultural items. In the event this happens, the appropriate tribe(s) and lineal descendants will be notified and necessary actions will be taken to protect the burials as prescribed by law.

Archaeological Resources Protection Act (16 U.S.C. §§ 470aa-470mm)	This Act provides for the protection of cultural properties located on public and Native American lands, establishes permit requirements for the excavation or removal of cultural properties from public or Native American lands, and establishes civil and criminal penalties for the unauthorized appropriation, alteration, exchange, or other handling of cultural properties. Reservoir drawdown to elevation 1,450 ft could result in new or increased exposure of cultural sites and potentially lead to vandalism. The Corps will develop appropriate monitoring methods to prevent or minimize vandalism.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. §§ 9601–9675) and the Resource Conservation Recovery Act (RCRA) (42 U.S.C. §§ 6901–6992k)	These two Acts pertain to hazardous and toxic materials. Based on pre-construction site investigation, the Corps does not expect HTRW to be a problem. Should this situation change during construction, the Corps will respond to the presence of HTRW within the requirements of the law (including notifying the EPA) and Corps regulations and guidance.
Farmland Protection Policy Act (7 U.S.C. §§ 4201-4209)	The proposed action would not result in the conversion of any prime, unique state, or locally important farmland to non-agricultural uses. These statues are not applicable.
Abandoned Shipwreck Act of 1987, (43 U.S.C. §§ 2101-2106)	The Corps knows of no abandoned shipwrecks to occur within the proposed action areas. These statues are not applicable.
Submerged Lands Act, (43 U.S.C. §§ 1301, *et seq*.)	No lands covered by the Submerged Lands Act occur within the project area. These statues are not applicable.

Executive Order 11988: Floodplain Management	This EO requires a federal agency, when taking an action, to avoid short- and long-term adverse effects associated with floodplain occupancy and modification. The agency must avoid direct and indirect support of floodplain development whenever floodplain siting is involved. Additionally, the agency must minimize potential harm to or in the floodplain and explain why the action is proposed. The Water Resources Council provided additional floodplain management guidelines for EO 11988 in 1978. Paragraph 6 of the Corps' implementation guidance in Engineering Regulation (ER) 1165-2-26 (March 30, 1984) states: EO 11988 has as an objective the avoidance, to the extent possible, of long-and short-term adverse impacts associated with the occupancy and modification of the base floodplain and the avoidance of direct and indirect support of development in the base flood plain wherever there is a practicable alternative. Under the Order, the Corps is required to provide leadership and take action to: • Avoid development in the base flood plain unless it is the only practicable alternative; • Reduce the hazard and risk associated with floods; • Minimize the impact of floods on human safety, health and welfare; and • Restore and preserve the natural and beneficial values of the base floodplain. General procedures to implement Executive Order 11988 include eight steps as outlined and evaluated for this Project: 1. Determine if the proposed action is in the base floodplain (1% ACE): The proposed action is within the base floodplain. 2. If the action is in the floodplain, identify and evaluate practicable alternatives to locating in the base floodplain: The project assesses alternatives to provide downstream passage for ESA listed UWR spring Chinook. There are no practicable alternatives to locating fish collection activities outside the base floodplain. 3. Provide public review: The Corps has advised the public of the proposed action and requested public comment on the recommended plan. 4. Identify the impacts of the proposed action and any expected losses of natural and beneficial floodplain values: The alternatives will neither change the base floodplain elevation nor result in losses of natural and beneficial floodplain values. 5. Minimize threats to life and property and to natural and beneficial floodplain values. Restore and preserve natural and beneficial floodplain values: The proposed action is unlikely to induce development in the floodplain. 6. Reevaluate alternatives: No alternatives considered are likely to induce development in the floodplain Issue findings and a public explanation: To be completed after public review.

Executive Order 12898: Environmental Justice for Low Income & Minority Populations	This EO requires a federal agency, when taking an action, to provide for meaningful public involvement of minority and low-income populations. All construction, operation, and maintenance activities for the proposed action and alternatives will occur on federal lands. All activities and any potential release of contaminants or regulated substances that may adversely affect the environment will remain on federal lands or will be contained within the navigable waters of the U.S. A review of the demographics within the bounds of the potentially affected areas (Cougar Reservoir downstream to the confluence of the McKenzie and Willamette Rivers) by future activities does not reveal any potential demographic who may be unduly affected by a potential negative environmental consequence because of Corps operations or policies. After a thorough review of the potentially affected area by the proposed action, no group of people appears to bear a disproportionate share of the potential negative environmental consequences resulting from actions or negligence of a federal employee, its contractor(s), or agent(s). The Corps will provide public involvement via a public review of the EA, through the customary 30-day public review period. Should a particular demographic be identified as potentially adversely affected by future government actions, the review period will immediately stop and renewed planning efforts will commence until an appropriate alternative is in place to avoid or completely ameliorate any environmental consequence that disproportionally affects any one demographic group.
Executive Order 13045: Protection of Children from Environmental Health Risks and Safety Risks	Under this Executive Order, federal agencies shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children, and shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. The project would not result in environmental health risks and safety risks that may disproportionately affect children and is therefore in compliance with this Executive Order.

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9. APPENDICES

Appendix A. Past, Present, and Reasonably Foreseeable Actions

Appendix B. Hydropower Impacts Analysis

Appendix C. Recreation Analysis

Appendix D. Socioeconomic Analysis

Appendix E. 2016 Fish Salvage Plan for the Debris Removal and Intake Tower Trash Rack Repairs at Cougar Dam on the South Fork McKenzie River

Appendix F. 2016 Performance Criteria for Cougar Dam Floating Screen Structure

Appendix G. 2011 Cougar Adult Fish Facility Operations and Maintenance Manual